THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1621.] LONDON, JUNE 5, 1894. [46TH YEAR. PRICE 6d.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

WOLSTON'S
TORBAY PAINTS
Special Quotations to Gas Companies.
DARTMOUTH, DEVON.

Lanemark Coal Co.,
LIMITED.
LANEMARK CANNEL
AND GAS COALS.
Quotations and Analysis on application to
LANEMARK COLLIERY,
NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

ESTABLISHED 1830.—
PARKER & LESTER,
Manufacturers & Contractors.
THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores for Gas and Water Works.
WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.

Ashmore, Benson, Pease, & Co., Ld.,
STOCKTON-ON-TEES,
Manufacturing Gas Engineers.

See Advt. p. 1040 of this week's issue.

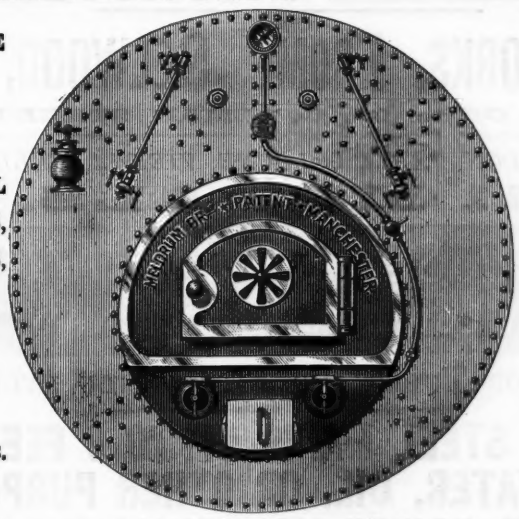
NORTON'S PATENT
"ABYSSINIAN" & ARTESIAN TUBE WELLS,
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
LE GRAND & SUTCLIFF,
HYDRAULIC ENGINEERS, 125, BUNHILL ROW, LONDON, E.C.

DUST-FUEL FURNACE
(MELDRUM'S PATENT).

BURNS ANY KIND OF WASTE FUEL TO ADVANTAGE.

SUPPLIED to the PRINCIPAL GAS-WORKS, WATER-WORKS, ELECTRIC LIGHT STATIONS, &c., &c.

LONDON OFFICE:
16, UNION COURT,
OLD BROAD STREET, E.C.
WILLIAM BOBY, Agent.



OVER
1900
WORKING.

MELDRUM BROS., ATLANTIC WORKS, 13, CITY ROAD, **MANCHESTER.**
Telegrams: "MELDRUM, MANCHESTER." National Telephone No. 1674.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765).

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

EDWARD COCKEY & SONS, LIMITED,

ENGINEERS & CONTRACTORS FOR GAS-WORKS.

TELEGRAPHIC ADDRESS: "COCKEYS FROME."

THE IRON-WORKS, FROME.

Messrs. COCKEY desire to draw the attention of Gas Engineers and Managers to their new form of GAS WASHER, which, by a recent patent, converts their HORIZONTAL Washer into one of a VERTICAL form.

The principle is the same as in the horizontal one, which has now been before the profession for a number of years, and where adopted is giving unqualified satisfaction.

The Washer is entirely automatic in its action, and does not therefore need any motive power—an advantage which will be apparent to all.

It is made in all sizes, from 25,000 TO 3,000,000 FEET PER DAY; and Messrs. COCKEY invite inquiries, which shall have early attention.

March, 1891.

PRICES ON APPLICATION TO THE SOLE MAKERS.

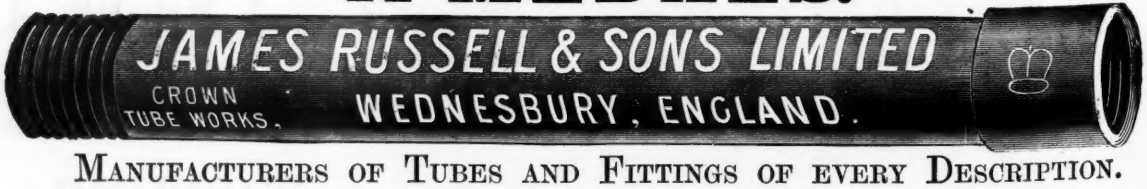
MAKERS OF FISH AND SMITH'S PATENT (NO. 5108) OVERFLOWS FOR REGULATING THE SEAL IN GAS-WASHERS, &c.

THE IRON-WORKS, FROME SELWOOD, SOMERSET.

London Office: 22, COLEMAN STREET, E.C.

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

—11 MEDALS.—



MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

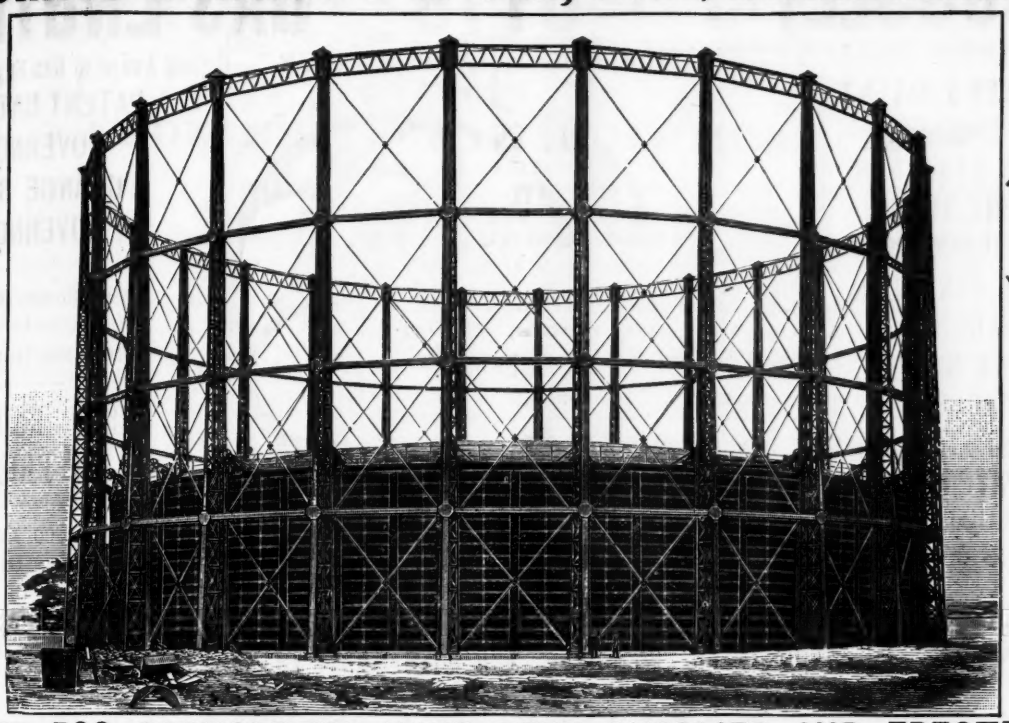
SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON: 108, Southwark Street.
BIRMINGHAM: 114, Colmore Row.
LEEDS: 6, Mark Lane, New Briggate.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT. FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS, BIRMINGHAM.

WELDED & RIVETED PIPES, FOUL MAINS, RETORT. LIDS, WROT. & CAST TANKS, PURIFIERS.

OVER 500 GASHOLDERS HAVE BEEN SUPPLIED AND ERECTED,

INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

BATH.	BOLTON.	BRISTOL.	CHELTENHAM.	LEAMINGTON.	PRESTON.	SHEFFIELD.
BELFAST.	BOMBAY.	BRISBANE.	HARTLEPOOL.	LIVERPOOL.	READING.	STOCKHOLM.
BECKTON.	BRADFORD.	CARDIFF.	LEEDS.	NOTTINGHAM.	RIO GRANDE.	SYDNEY.
BIRMINGHAM.	BRIGHTON.	COVENTRY.	LEICESTER.	OLDHAM.	SOUTH METRON.	VIENNA.

GAS COAL.

BEST

REAL OLD SILKSTONE GAS COAL,

Address THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

NEWTON, CHAMBERS, & CO., LIMITED,

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

SLIDE VALVES, WITH RACK & PINION OR Internal or External SCREWS of all sizes.

GASHOLDERS, AND Gasholder Tanks.

CAST-IRON RETORTS,

RETORT-BED FITTINGS,

And Retort-House Appliances

of every description,

Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.

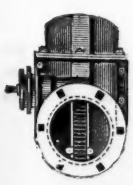
WROUGHT AND CAST IRON CONDENSERS, SCRUBBERS, & WASHERS,

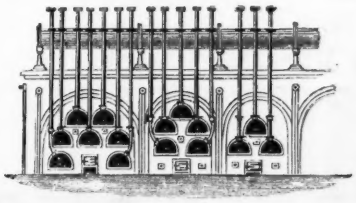
TAR AND LIQUOR PUMPS, &c.

PATENT CENTRE-VALVES

for working Purifiers,

Also Bye-Pass & Stop Valves.



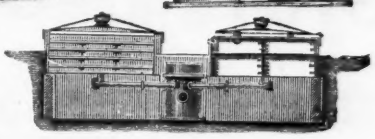


PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS.

WOOD GRIDS.

CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

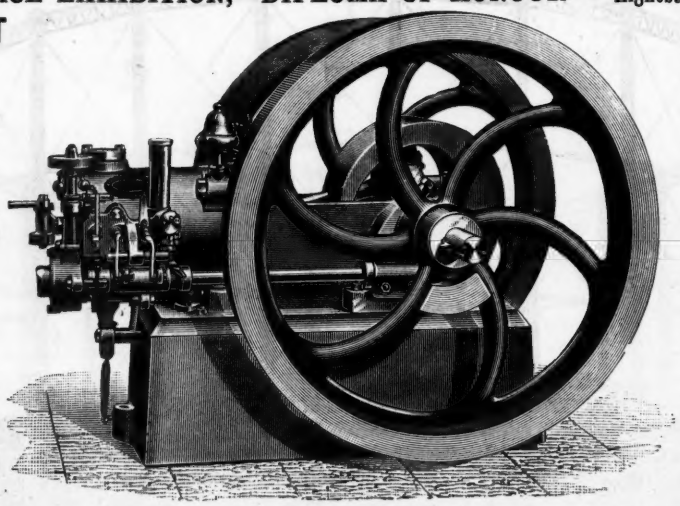
Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

CROSSLEY'S "OTTO" GAS-ENGINE.

CRYSTAL PALACE EXHIBITION, "DIPLOMA OF HONOUR"—Highest Award to Gas-Engines.

CROSSLEY'S PATENT OIL-ENGINES, PATENT STARTERS, PATENT TUBES FOR IGNITION, PATENT PENDULUM GOVERNORS, PATENT SAFETY HANDLES, PATENT TIMERS, PATENT ANTI-FLUCTUATING GAS-BAGS.



PATENT CATARACT GOVERNORS, CHANGE SPEED GOVERNORS.

Every Engine thoroughly tested before being sent out

ALL PARTS MADE STRICTLY TO GAUGE

GREAT REDUCTION IN PRICES.

OVER 800 ENGINES ALWAYS IN HAND.

CROSSLEY'S NEW HIGH-SPEED ENGINE FOR DIRECT ELECTRIC LIGHTING.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.

HARRIS & PEARSON,

STOURBRIDGE, ENGLAND,

MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

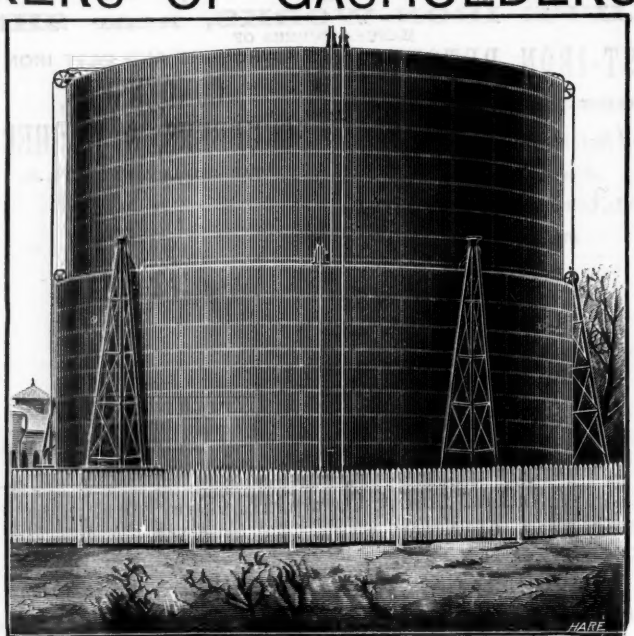
GLAZED BRICKS AND PORCELAIN BATHS.

ASHMORE, BENSON, PEASE, & CO., LIMITED,

GAS-WORKS CONTRACTORS, STOCKTON-ON-TEES.

SOLE MAKERS OF GASHOLDERS ON THE

WIRE ROPE SYSTEM



WIRE ROPE SYSTEM

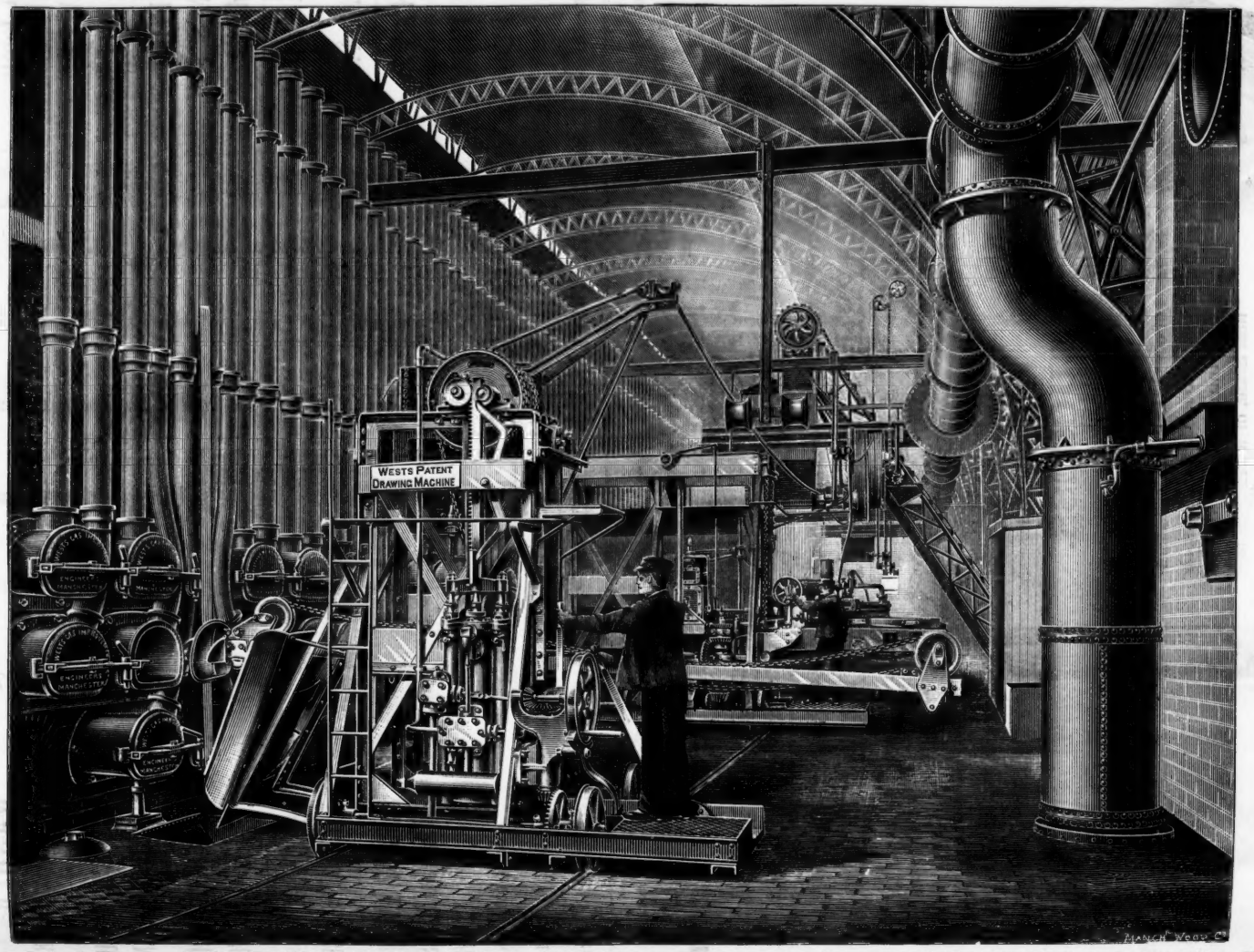
This Engraving is taken from a Photograph of a Holder **increased in capacity from 32,000 cubic feet to 59,000 cubic feet** by the addition of a Lift. The Ropes are applied to both Lifts to supplement the Standards.

LONDON OFFICE: 15, VICTORIA STREET, S.W.

WEST'S GAS IMPROVEMENT COMPANY, LTD.,

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER.

WEST'S MANUAL AND POWER MACHINERY FOR CHARGING AND DRAWING GAS-RETORTS.



Interior of Retort-House at the Bradford Road Gas-Works, Manchester, showing the Compressed-Air Drawing and Charging Machines.

OVER 560,000 LINEAL FEET OF RETORTS DAILY ARE CHARGED AND DRAWN BY WEST'S MACHINES.

Telegraphic: "Fortress, Donnington, Salop."

C. & W. WALKER,

Telegraphic: "Fortress, London."

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

London Office: 10, FINSBURY SQUARE.

PURIFIERS with Planed Joints.

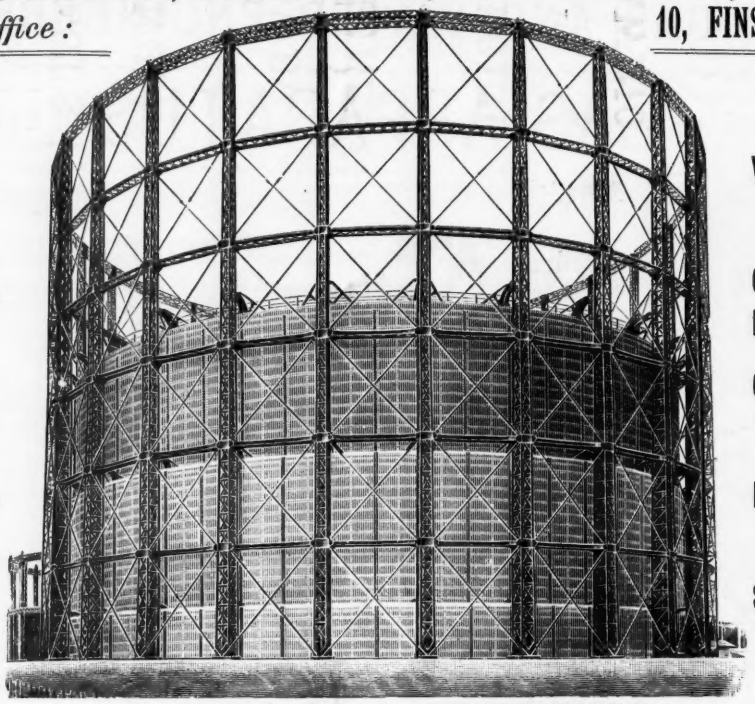
TOWER SCRUBBERS.

PURIFYING-MACHINES FOR AMMONIA.

CONDENSERS.

TAR PLANT.

SULPHATE OF AMMONIA PLANT.



GASHOLDERS.

WASHERS.

WASHER-SCRUBBERS.

CLAUS' SULPHUR-RECOVERY PLANT.

CENTRE & FOUR-WAY VALVES.

RETORT-MOUTHPIECES.

SLIDE-VALVES, TAR-BURNERS, SIEVES, &c., &c., &c.

The above is a view of the largest Gasholder (four-lift) of The Gaslight and Coke Company, Beckton, containing 8 million cubic feet, erected by us in 1892.

Sole Makers of **WECK'S** Patent CENTRE-VALVE, & **CRIPPS'** Patent HYDRAULIC MAIN VALVE.

THE AUTOMATIC GAS-METER CO., LTD.,

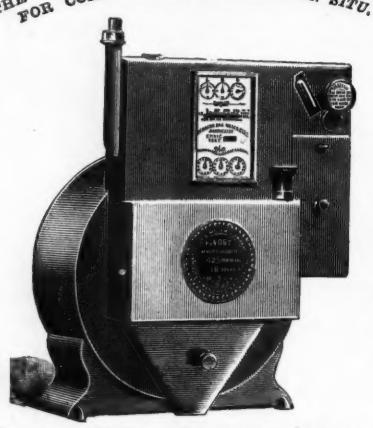
UPPER BROOK ST., MANCHESTER.

SOLE PROPRIETORS OF

THORP, MARSH, AND HAYNES' PATENTS.

PENNY-IN-THE-SLOT GAS-METERS.

THE AMOUNT OF GAS GIVEN IN EXCHANGE FOR COIN CAN BE ALTERED *IN SITU*.



The persistent efforts of the Inventors of our Meters have been crowned with

SUCCESS.

There can be no two opinions on the question of the priority of our claim to the consideration of Gas Companies as *the First* Introducers, on a Practical Scale, of a Penny-in-the-Slot Meter.

THE AMOUNT OF CASH PLACED IN THE BOX IS RECORDED. THIS IS A COMPLETE CHECK AGAINST FRAUD.

PENNY-IN-THE-SLOT GAS-METERS.

So long ago as 1889, we advertised our Penny-in-the Slot Meters as having the now fully-recognized advantage of ability to alter IN SITU. Automatic Meters without Coin-Counting Index are liable to be tampered with.

PRICES AND FULL INFORMATION FROM

LONDON: ALBERT BUILDINGS, 49, QUEEN VICTORIA ST., E.C.

MANCHESTER: UPPER BROOK STREET.

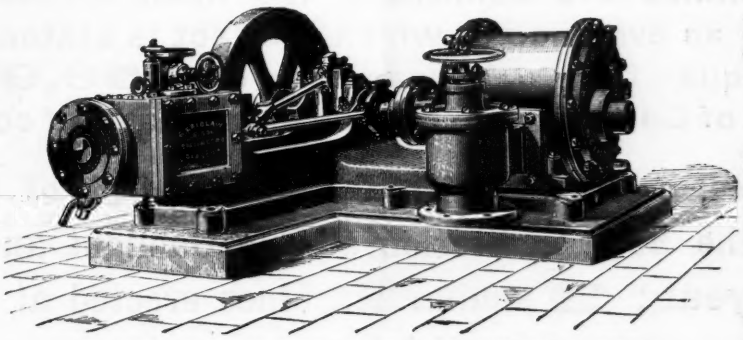
LEEDS: 5, MERRION STREET.

R. LAIDLAW & SON,

GAS AND WATER ENGINEERS.

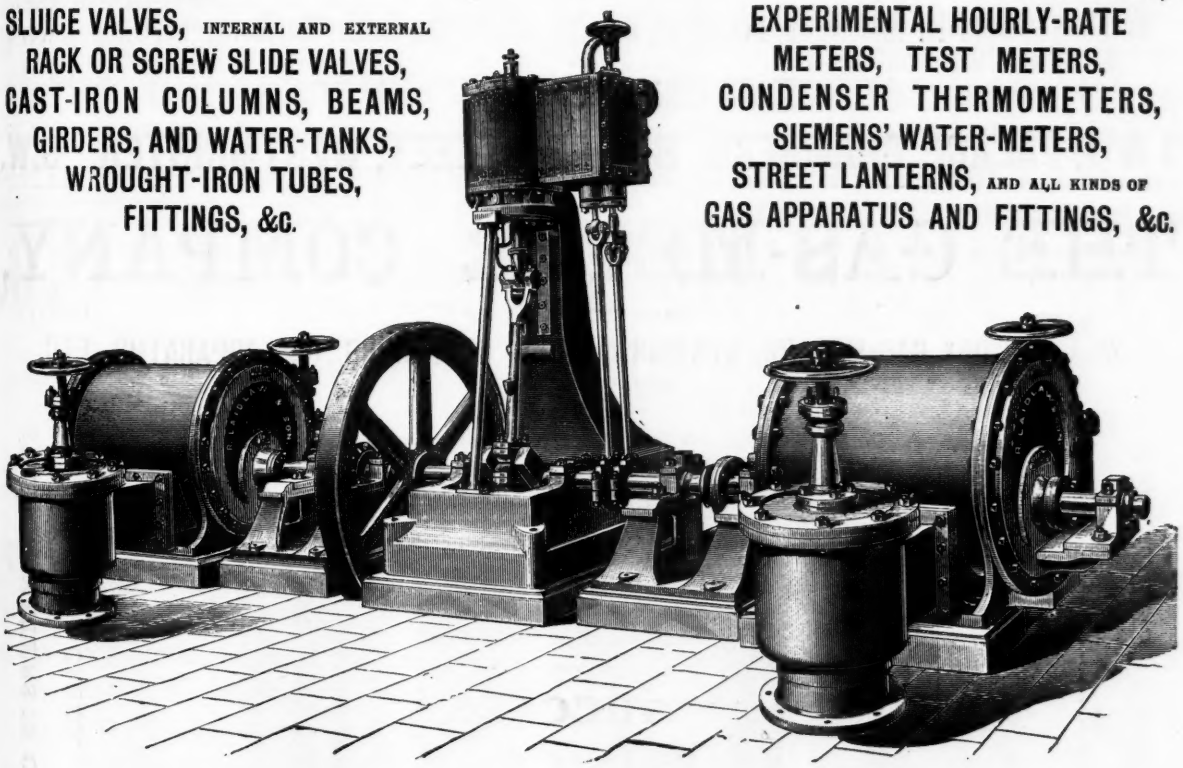
Manufacturers of **GAS APPARATUS** of every Description.

Makers in Glasgow of
CAST-IRON PIPES, ALL SIZES,
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING-ENGINES For Water-Works.
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES, INTERNAL AND EXTERNAL
RACK OR SCREW SLIDE VALVES,
CAST-IRON COLUMNS, BEAMS, GIRDERS, AND WATER-TANKS,
WROUGHT-IRON TUBES, FITTINGS, &c.



BEALE'S GAS EXHAUSTER AND ENGINE COMBINED. All Sizes.

Makers in Edinburgh of
WET AND DRY GAS-METERS, IMPROVED
STATION GOVERNORS,
PRESSURE REGISTERS
PRESSURE GAUGES,
TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS, TEST METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS, AND ALL KINDS OF
GAS APPARATUS AND FITTINGS, &c.



BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED. All Sizes.

Prices, with full Particulars, will be given on application.

Two Gold Medals, One Silver Medal, One Bronze Medal, and Two Honourable Mentions,
INTERNATIONAL EXHIBITION, EDINBURGH 1886.

ALLIANCE FOUNDRY, **GLASGOW.** | SIMON SQUARE WORKS, **EDINBURGH.** | 6, LITTLE BUSH LANE, **LONDON, E.C.**

KIRKHAM, HULETT, & CHANDLER'S,

PATENT LIMITED,

"STANDARD" WASHER-SCRUBBERS

These Machines are admittedly the most efficient of any in the Market, as evidence of which the fact is stated that 476 of them, equal to a daily capacity of 459,972,000 cubic feet of Gas, are in operation or in course of construction.

4 Machines, each for 3,500,000 cubic feet of Gas per day, erected at the Beckton Station of The Gaslight and Coke Company last year; 2 similar Machines erected at same Works this year.

Machines in hand for Silvertown, Devonport, Dorking, Accrington, Berlin, Marlborough (U.S.A.), &c.

ADDRESS:

3 & 4, PALACE CHAMBERS, BRIDGE STREET, WESTMINSTER, S.W.

THE GAS-METER COMPANY,

MANUFACTURERS OF LIMITED

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.

STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, LATE WEST & GREGSON. Established 1830.

For Prices and Particulars apply to **R. L. ANDREWS, General Manager.**

Works: 238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

Telegraphic Address: "METER."

[See Advertisement on back of Wrapper.

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

LONDON Offices & Depôts:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.

MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

TELEGRAPHIC ADDRESS:
"ROBUSTNESS LONDON."

GAS & WATER WORK
J. & H. ROBUS,
ENGINEERS & CONTRACTORS,
20, BUCKLERSBURY, LONDON, E.C.,
furnish Plans, Estimates, and Specifications for SINKING BOREHOLES *and* WELLS; *Erecting* RESERVOIRS, FILTER-BEDS, *and* GASHOLDER TANKS; *and* EVERY REQUISITE *for* GAS *and* WATER WORKS
INCLUDING
MAIN LAYING
EXCHANGE TELEPHONE 1756.

FOR **TUBES AND FITTINGS** APPLY TO
JOHN BROTHERTON, LTD., IMPERIAL TUBE WORKS, **WOLVERHAMPTON.**

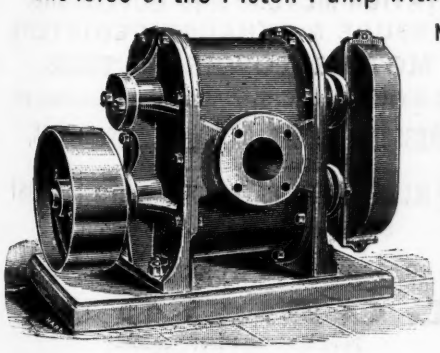
INCLINED RETORTS,
FIRE BRICKS,
LUMPS, TILES,
BLOCKS, &c.
Special Bricks for Intense Heats.

GAS RETORTS.

CASTINGS AND EVERY REQUISITE FOR GAS-WORKS.

MOBBERLEY & PERRY,
Fire-Brick Works, STOURBRIDGE.
Retort Setters sent to any part of the Kingdom.

JOHNSON'S PATENT
DRUM PUMP AND GAS EXHAUSTER.
The Pump of the future for quickly and economically moving large bodies of Water, Semi-Fluids, &c.
The force of the Piston Pump with the capacity of the Centrifugal combined
NO SLIDES OR FRICTIONAL WORKING PARTS.



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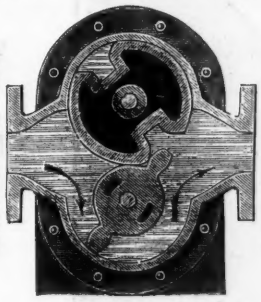

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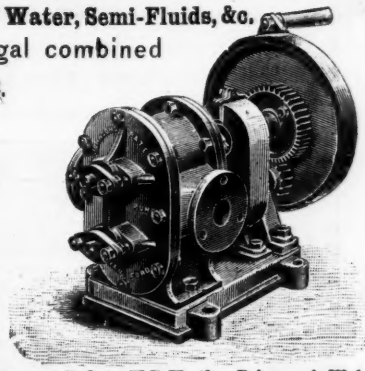


As supplied to H.R.H. the Prince of Wales for Pumping Gas Liquor at his Sandringham Gas-Works.

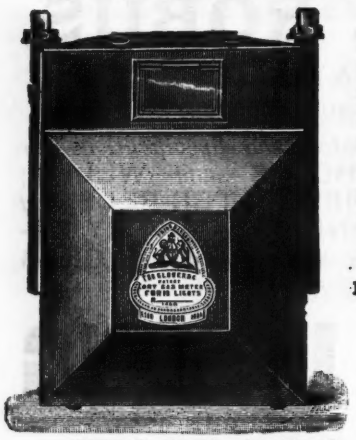
DRUM ENGINEERING COMPANY,
Hydraulic and Pneumatic Engineers, 55, ATHOL ROAD, BRADFORD.

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;

The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
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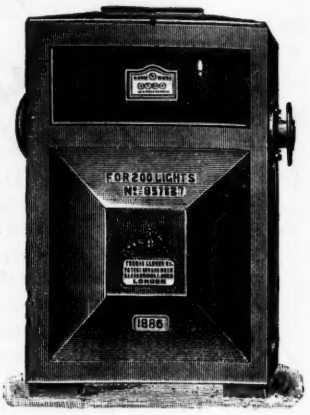

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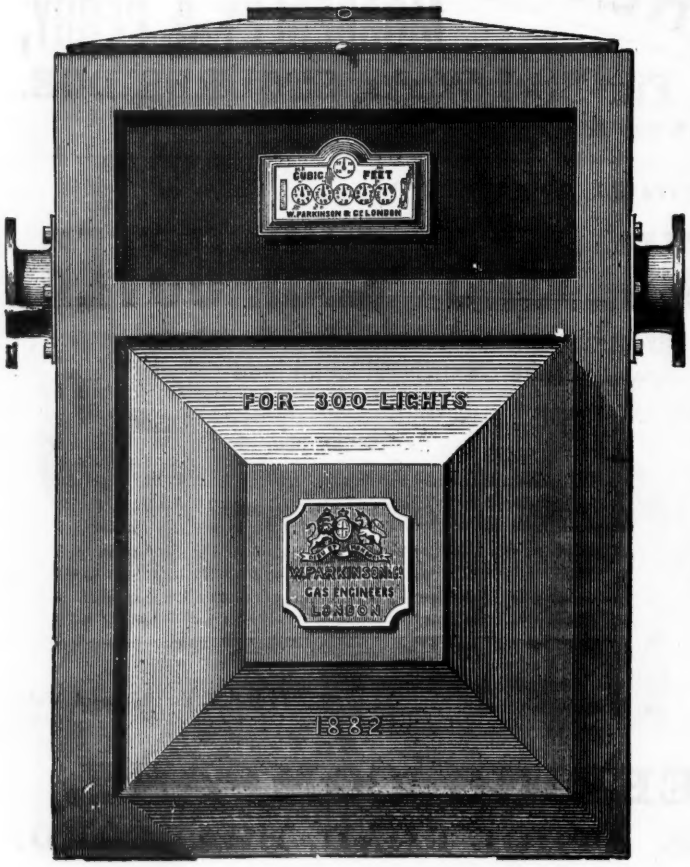

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 5, 1894.

The Programme of The Gas Institute.

THE official programme of the approaching meeting of the Incorporated Gas Institute has been issued; and full particulars of the nature of the *agenda* prepared for the business sessions, which are to extend over three whole days, will be found in another column. We can unreservedly congratulate the President of the Institute—Mr. John West—as well as the Council, upon the promise they have been able to offer of a really useful and enjoyable meeting. A good deal of credit is also due to the painstaking Secretary—Mr. F. G. Burfield—for the completeness of all the arrangements made for the meeting; and if the gathering does not attain, and even surpass, the standard of success marked by the best of the meetings held since the Institute began to recover from its constitutional troubles, it will not be the fault of the present chiefs of the organization. The Presidential Address by Mr. West can hardly be other than interesting and instructive, coming as it will from an Engineer of the most extensive and varied experience in gas manufacture and gas-works management, and one, moreover, who has made more friends in the profession the longer he has lived his active life. We understand that the balloting-list of new members to be submitted to the meeting contains the handsome total of 53 names, of which 32 are applicants for admission to full membership; and this piece of evidence of the vitality of the Institute is something upon which the Council and members generally may reasonably felicitate themselves. In their annual report, the Council, when alluding to this matter, declare that they take the continued growth in the number of applications for admission to the Institute as "unmisteakable evidence of the high esteem in which "the Institute is held by the profession—both as regards "its continued usefulness as an educational medium and "as a means for the dissemination of technical knowledge "as well as the interchange of practical experience."

According to the report, since the last meeting eleven resignations have been received and accepted, and there have been thirteen deaths of members and associates. It is remarked that the general financial position of the Institute has at length been satisfactorily adjusted. It is well known that, about the period of the "great disrup-"tion," the Institute became committed to a largely increased expenditure for no apparent benefit. Wiser counsels have latterly prevailed; economies have been effected all round, while the revenue has been slowly recovering. Consequently, the Institute has turned the corner of the road that appeared to be leading towards insolvency; and members will see with satisfaction that the revenue account for last year shows a balance on the right side, notwithstanding the unpleasant circumstance of subscriptions to the amount of £58 having to be written off. Credit is due to those who have had the responsibility of the administration of the affairs of the Institute of late years, for having managed the finances so prudently as to bring the Institute through its financial pinch without touching the invested capital. It is now time, however, that the outstanding balance of the legal expenses of incorporation were cleared off. If it were not for the contributions of Gas Companies and Corporations, amounting for the past year to £109, the balance of the revenue account would still have been on the wrong side. The Council admit that their thanks are due "to those Companies and "Corporations who have subscribed to the funds of the "Institute; thus enabling its Technical Committee to "continue the work of research." But what work of the kind has the Committee accomplished for the past year? To be quite frank, we do not think that the Council are justified in including this money in their ordinary revenue, year after year, without doing anything special in return for it. Nobody wishes to be hard upon the Institute; and there has been some excuse for applying all the money that could be raised by hook or by crook to the paramount necessity of keeping the organization alive. But it is hardly correct to describe Gas Companies' subscriptions as enabling the Technical Committee to "continue the "work of research," when nothing of the sort is on foot. The Institute will therefore not be quite solvent until all the ordinary expenses are defrayed out of members' subscriptions, interest on investments, and sales of Transactions. We do not say that Gas Companies' subscriptions should cease while there did not happen to be any research work in progress. But this money ought in strictness to be set aside for some such purpose; and then it might do some good. As it is, we fail to see any justification for the outlay of public money in aid of the funds of a particular society of gas managers.

The announcement is made in the report that the Birmingham Medal is to be awarded to Mr. W. A. Valon, "for the valuable services he has rendered the gas in-"dustry by his important experiments and research;" and with this selection there will not be much cavilling within the ranks of the Institute. So far there is nothing in the official statement of the aims and proceedings of the

Council to arouse adverse comment. But unfortunately, the report contains other disclosures which cannot be allowed to pass unchallenged. The first of these relates to the declared intention of the Council "to take up the parliamentary work of the late Gas Companies' Association," and to the announcement that they "have engaged the services of Mr. William Livesey, the late Secretary to the Gas Companies' Association, to assist them in the matter." We can only say that the Council must have been suffering from a strange aberration of their collective intellect, which it is to be hoped was merely transitory, when they adopted such a fatuous resolve. In the first place, the idea entertained of usurping possession of the movement for the reconstitution of the old Gas Companies' Association is a blunder of the first magnitude for the Council of The Gas Institute to commit, seeing that it had already been suggested by others. Secondly, the notion of committing the Institute to the guidance in this matter of Mr. William Livesey, for whom, on account of his advanced age and failing health, a general subscription fund has just been raised within the limits of the gas industry of the United Kingdom, is one of those astounding pieces of ineptitude that strike one as too gross for discussion. We have the highest respect for Mr. William Livesey, as all our dealings in his regard abundantly witness; but what could have possessed the Council of The Gas Institute to trouble the good old man thus? Did he appear before them in person? Has one member of the Council personal knowledge of his actual physical condition?

Lastly, the report states that "a design for an official certificate of membership has been adopted by the Council; and copies will be ready by the date of the annual general meeting." Thus another piece of superfluous folly which the Institute has been saved from committing all the years of its existence will be perpetrated at last. The best friends of the Institute must grieve that just at this period, when the public feeling of dislike and mistrust of meaningless personal attributes, in the guise of "strings of initials" appended to men's names, has culminated in protest and ridicule, this merely mutual organization should be ready to fall into the error of so pandering to the vanity of its shallowest members as to issue to them pieces of paper whereby they may advertise themselves as belonging to what is nothing more nor less than a trade society. There is a kind of man who likes this sort of thing; but if the Council of The Gas Institute have reason to know that the right to a certificate of membership which can be framed and glazed by its proud possessor, is likely to be regarded as an additional inducement to procure subscribers to their funds, all we can say is that the natural reflection is not complimentary to the victims of such a fancy.

In our "Technical Record" to-day will be found a full list of the papers to be submitted to the meeting; and consequently no recapitulation of their titles and authors need be made here. It may be pointed out, however—for it is a fact of which any technical society may well be proud—that the whole of them, with one exception, are contributed by members of the Institute.

Important Trial of Uncarburetted Gas.

In the course of his evidence given in support of the Plymouth and Stonehouse Gas Bill before Sir James Kitson's Committee, Mr. George Livesey incidentally made a statement bearing upon the subject of our last week's article entitled "The Case for Low-Grade Gas" which should be noticed in conjunction with other reported contributions to the settlement of this question. Mr. Livesey was giving his reasons for objecting to the proposal to increase the nominal illuminating power of the gas supplied to Plymouth, which would involve enrichment; and he showed that this would be a costly mistake, inasmuch as the consumer practically derives no advantage from raising 14-candle gas to 15 candles, while he has to pay 2d. per 1000 cubic feet more for the additional candle. Mr. Livesey went on to state that, with the assent of the London County Council, the South Metropolitan Company carried out an experiment lasting for the fortnight ending on the 5th ult., in supplying gas without enrichment to the whole of the district. The precise results of the experiment as observed at the different testing-stations, at the various stations, and in the district, have not yet been published; but Mr. Livesey was able to tell the Committee that, while there was a reduction of the nominal illuminating power, at some places, of a candle, and at others of as much as a candle and a half, the consumers knew nothing of what was going on. Indeed, there were fewer consumers' complaints of "bad lights" for the test fortnight than usual. But no stress was laid upon this bare fact, beyond using it in support of the witness's contention that, so far as the consumers' interests were involved, the stoppage of enrichment made no difference whatever. Thereupon followed these noteworthy questions and answers. Question by Mr. Pope, Q.C.: "Therefore, of course, for the purpose of the consumer, the enrichment had been just so much thrown away?" Answer: "Yes." Question: "Therefore, although undoubtedly there has been a Bill in Parliament to fix 15 candles as the standard illuminating power apparently, do you recommend that any change should be made at Plymouth?" Answer: "I do not. We have all been under a mistaken impression. This has never been put before a Committee before; it is only since the Crystal Palace case that I have thought much about it myself." The significance of the last remark consists in its being a recantation of the same witness's admission in the Crystal Palace case, when, as he now confesses, he gave way on the point of raising the standard of illuminating power from 14 to 15 candles, tested in the district, in the belief that this quality of gas could be supplied from Durham coal without enrichment. Mr. Livesey told the Committee in the present instance that he would not have consented to the alteration if he had known then what he knows now. We understand, moreover, that, though the South Metropolitan experiment referred to only lasted a fortnight, the gas during this time was made from all the kinds of coal purchased by the Company, and the average product was something like 15-candle gas. It is quite possible that some question may be raised as to the action of the London County Council in this matter; but it will strike most reasonable people that, since the option of taking proceedings for deficiencies of illuminating power rests with the Council, they exercised a wise discretion in encouraging an experiment in gas supply which may greatly benefit the gas consumers of London. So far as it goes, it is possible to regard the experiment as strengthening the views of Mr. Livesey, Mr. Newbigging, and Professor Lewes with regard to the most advantageous quality for London gas. It is to be hoped, however, in view of the immense importance of the question at issue, that the same kind of experiment will be tried in the other Metropolitan gas supply districts, and by all the Companies at different seasons of the year. The first trial will do very well as an illustration of what may be done with ordinary coal gas without enrichment at the time of the year when the temperature of the air is equable. But it is desirable that the influences of extreme heat and cold should also be ascertained before a conclusion is definitely arrived at respecting the principle at stake.

The Fruit of the Labours of the Standards of Light Committee.

It is with very great satisfaction that we are able to announce that the Standards of Light Committee have unanimously agreed upon the substance of their report, which will shortly be issued together with a full statement of the nature of the investigations upon which their conclusion is based. We understand that the Committee will recommend to the Board of Trade the legalization of Mr. A. G. Vernon Harcourt's pentane one-candle standard, which they declare to be a correct representation of the average light given by a parliamentary standard candle, and to possess the advantages of easy and reliable reproduction, as a substitute for the actual candle hitherto employed in the statutory testing of the illuminating power of London gas. Furthermore, and in view of the fact that, in the ordinary practice of the photometry of gas-flames of 16-candle power or thereabouts, it is preferable to compare the light of such flames with a standard light of not greatly inferior value, the Committee will advise that Mr. Dibdin's ten-candle pentane standard is an exact multiple of the Harcourt single-candle standard, and is therefore a desirable one for practical working. Certain other recommendations will be made in the report—notably one in respect of the rate at which the gas under test is to be burnt. For exact particulars of these, however, it will be necessary to await the publication of the

report itself. For the present, the Committee and their Secretary (Professor Vivian B. Lewes) are to be heartily congratulated upon the gratifying circumstance of their protracted, tedious, and delicate inquiry having resulted in a unanimous report. It can be easily understood that great patience and no little public spirit must have been required for the attainment of such a result, which can only have been reached by the collection and determination of a vast number of experimental data, by treating such data in a judicial spirit, and by the rigid subjection of manifold interests, predilections, and individual opinions to the paramount duty laid upon the Committee of finding an acceptable way out of the long-standing confusion in which the whole matter of statutory gas testing has remained for the period of a generation. Steps will, of course, be taken to make the decision of the Committee operative in the case of London; and it is much to be desired that a short Act should be passed making the adoption of the new standard optional in other gas supply districts.

Field's "Analysis" for 1893.

THE annual volume of Field's "Analysis" of the accounts of the principal gas undertakings of the United Kingdom for the year 1893 has just appeared. No commendation of ours is needed for this standard work of reference, which is simply indispensable for all who seek information respecting the working of British gas undertakings year by year. We do not propose to offer any comparative observations upon the statistics revealed by Mr. John W. Field; but the piquancy of some of the figures given by him relating to the gas supply of the different districts into which London is divided for the purpose is not destroyed by the circumstance of the author's having become a maker as well as the compiler of a portion of these data. The undertakings now catalogued by Mr. Field represent, for the Metropolis, employed capital amounting to £16,517,689; for the suburban districts, £2,946,168; for provincial cities and towns, £15,800,410. In view of the interest that has been taken in the subject, it may be recounted that the consumption of gas in the Metropolis last year shows an average decrease of 3·63 per cent., while that for the suburban districts diminished on an average 0·82 per cent. On the other hand, there was an average increase of 1·37 per cent. for the English Corporation gas undertakings; Glasgow had an increase of 4·80 per cent.; the English Companies showed a decrease of 1·10 per cent.; and the Dublin undertaking, one of 2·49 per cent. Whoever can deduce a sound generalization from all these returns is welcome to essay the task. Mr. Field gives two appendices to his tables, one stating the amounts realized for residuals per ton of coal only, and the other showing the amount of capital employed per 1000 cubic feet of gas supplied on the days of maximum delivery—this latter being a point that was made much of in connection with a recent controversy. The result of this computation is certainly startling. It appears that, taking the "record" daily output, this has been provided for by employing amounts of capital ranging from £191 to £35·5. London gets off with an average of £93·2; the Chartered and South Metropolitan data being respectively £94·9 and £94·5, while the Commercial is £71·6. The suburban figure, as might be supposed, is the highest, on an average; but there is a tremendous discrepancy, as already noticed, between the records for different undertakings. It would now be difficult to suggest anything whereby Mr. Field could make his work more complete; but yet he is continually expanding it, and rendering it more comprehensive and valuable. No labour is spared in the task; and how laborious a task it is, only those who have attempted something of the same nature can fully appreciate.

Award of a Premium to Mr. Charles Hunt.—At the meeting of the Institution of Civil Engineers last Tuesday evening, it was announced that among other premiums awarded was one to Mr. Charles Hunt, for his paper on "The Construction of Gas-Works," an abstract of which appeared in the JOURNAL for April 10 last (p. 651).

Reduction in Price by The Gaslight and Coke Company.—The Directors of The Gaslight and Coke Company give notice that, from the date of recording the meter indices for the current quarter, the price of gas will be reduced from 3s. 1d. to 3s. per 1000 cubic feet; and that, should the state of the Company's finances permit of it, a further reduction of 1d. will be made at the close of the December quarter.

WATER AND SANITARY AFFAIRS.

THE Select Committee of the House of Commons dealing with the Thames Conservancy Bill arrived last Wednesday at some important conclusions as affecting the Metropolitan Water Companies. The Chairman—Mr. Jackson—announced that the preamble of that portion of the Bill which treated of the water question was considered by the Committee to be proved. But at the same time the Committee were of opinion that clause 289, which sanctions the schedule regulating the quantity of water which the several Companies might take from the Thames, would require to be carefully amended, and perhaps redrafted, so as to comply in the first place with the instruction from the House, and in the next place to safeguard the existing rights of the several Companies. With regard to the schedule itself, the Committee were naturally in a little difficulty, until they saw the precise form given to the governing clause. The Committee thought it would be desirable to specify the quantities, if it could be done without prejudice to the rights of the Companies; but it would seem that the schedule as it stood was open to objection on this point. On the question of payments, the Committee felt that the Conservators were asking too much, though some addition to the present contributions was requisite to defray the cost of the increased duties these authorities would have to discharge. Instead of the £13,000 per annum proposed by the Bill, the Committee thought £7500 would be a reasonable sum.

The Committee having arrived at the foregoing conclusions, an adjournment became necessary, in order that the Conservators might have an opportunity of reconsidering the matter. There was the hope that the various parties concerned would agree upon such terms as would meet the views of the Committee; and it would appear that this was subsequently accomplished—clauses being brought up on Friday settling the increased amounts to be paid by the several Companies. The great difficulty with the Conservators has been the money question. Mr. Littler, who represented the Conservancy Board, declared in his opening address that it "passed the wit of man" to devise any other scheme than that put forward by the Conservators for raising the revenue rendered necessary by the Bill. It is a little amusing to find Mr. Cohen, on behalf of the County Council, commending the "force and eloquence" with which Mr. Pember argued against the proposal to add so largely to the contributions from the Companies. On this point, Mr. Cohen was quite in agreement with Mr. Pember. In other words, the County Council fraternised with the Water Companies to the extent of opposing the demands made by the Conservators. The day is coming—so the Council imagine—when they will be in the position now occupied by the Companies, and will have to bear whatever burdens may in the meantime be laid upon the latter. The Conservators, on their part, have shown great eagerness in pressing their claim for high remuneration. Not only in his opening address, but in his reply on the whole case, Mr. Littler urged that the full amount was wanted, and that the Water Companies were the proper people to pay it. "It was not pretended," so he argued, "that the "Companies could not afford this very small payment of "£13,000." But the learned Counsel failed to dwell upon the point that the Companies were already paying £18,000 per annum to the Conservators, and the latter had put a schedule to the Bill fixing the quantities to be taken from the river, so as to allow no increase on the volume already authorized. The Committee, by their decision, declare that the "very small payment" demanded was really exclusive. It is also apparent that the Committee desire to preserve the Water Companies in their present rights with respect to the abstraction of water. The Conservators practically seek to reduce the quantity at the disposal of the Companies, by a proviso in clause 289 of the Bill, whereby they stipulate that water drawn from any land within 500 yards of the Thames shall be reckoned as part of the measured quantity to be abstracted from the stream. Unfortunately, the report of the Royal Commission favours this assumption; but, seeing that the water is to be taken for the benefit of the public, and not merely for the profit of the Companies, it would be well if this unreasonable stipulation were expunged from the clause when amended. If, as contended by Mr. Littler, it is a matter of the "most vital importance" for the Conservators to have all the money they ask for, it is still

more important for the people of London to have an adequate supply of water. Yet the County Council, and a very considerable portion of the Press, have done their utmost to make it appear that the Water Companies, in seeking to maintain an ample supply, were attempting to perpetrate a great public wrong, and were committing a trespass in every gallon of water they took from the Thames.

The course pursued in the House of Commons by Mr. Seton-Karr, in order to checkmate the promoters of the Newcastle and Gateshead Water Bill, exhibited considerably more courage than discretion. The honourable member's motion to reject the Bill only met with the fate it deserved; for what are the facts? For six days, according to the statement of the Chancellor of the Exchequer, this Bill was before the Lords' Committee; but Mr. Seton-Karr remained unsatisfied. He refused to admit that the interests which he avowedly championed had been adequately considered. That, of course, may be a matter of opinion; but there is no room for two opinions as to the inconvenience of the step which the honourable gentleman adopted. His keen appreciation of the duties of a trustee led him to try to shelve a Bill of very great importance to a large community, simply because the Lords' Committee had not given effect to the individual views he represented. In pursuing this singular course, Mr. Seton-Karr was not exceeding his strict rights; but equally certain is it that he was flying in the face of well-established parliamentary custom. There was nothing to prevent him making his motion, except a sense of its absolute unfitness; and that ought to have been sufficient. In the result, the motion was negatived; and Mr. Seton-Karr brought down upon himself a vehement rebuke from the leader of the House.

The result, so far, of the litigation reported last week between the Mayor and Corporation of Bradford and the owner of certain lands adjoining one of the sources of water supply under the control of the Corporation, is distinctly satisfactory. The case, it is true, turned to some extent upon the consideration of questions arising on the construction of Local Acts of Parliament; but there can be no doubt that Mr. Justice North's decision accords with the general policy of the law as prescribed by the Water-Works Clauses Act, 1847, and by the various Special Acts granted to water companies and corporations throughout the kingdom. The action raised some very disagreeable points, because the contention of the plaintiffs was that the defendant was not acting *bonâ fide;* and this view seems to have been sustained by the learned Judge, who came to the conclusion that the defendant's contemplated operations in the neighbourhood of the water-works were merely intended to drive the plaintiffs to compensate him for abstaining from doing what he only ostensibly proposed to do. This, however, is more or less a personal question, upon which nothing further need be said; but, on broad grounds, it is well to bear in mind that, however reluctant the Courts may be to interfere with the rights of landowners, such rights must not be allowed to infringe upon the plain enactments of the Legislature. In the case of water companies or corporations furnishing a water supply, it is necessary, in the public interests, that landowners shall not be permitted to divert, alter, or appropriate the sources from which the undertakers are exclusively authorized to draw. Although the sections of the Special Acts which were the subject of controversy were not, in the Judge's opinion, very happily expressed, his Lordship arrived at the conclusion that, while they were intended to preserve against the Corporation such rights over the waters in question as the upper riparian proprietor has against the lower riparian proprietor in an open stream, yet that it was not intended to permit a diversion, or appropriation by way of diversion, of the whole source of supply. Nor, indeed, is it easy to see on what ground, without stultifying the Legislature, the defendant's contention could have been upheld. Much legal ingenuity was expended on the case, which, undoubtedly, was one of wide importance; but it is satisfactory to note that the learned Judge's decision seems to be in full accordance with the plain requirements of common sense. The outcome was that the Court granted an injunction to restrain the defendant from making the drift or tunnel which he proposed to make, or from carrying out any other similar works whereby the waters of the plaintiffs' spring would be drawn off or materially diminished in quantity, or be subjected to pollution.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, MAY 9 & 10, 1894,

Mr. ALFRED COLSON, M.Inst.C.E., President.

PAPERS AND DISCUSSIONS.

In the JOURNAL last week, we published the first of the group of papers on enrichment—that by Mr. J. Ferguson Bell, of Stafford—read at the above meeting. We now complete our report of the technical portion of the proceedings by giving the papers of Mr. S. Glover and Mr. W. R. Herring, with the discussion upon the important subject dealt with in the three papers.

NOTES ON THE ENRICHMENT OF COAL GAS,

MORE PARTICULARLY BEARING UPON ENRICHMENT BY THE PEEBLES OIL-GAS PROCESS.

By S. GLOVER.

The subject of gas enrichment has engaged the attention of gas engineers during the past few years in an especial degree, owing to the necessity which has been thrust upon them to find substitutes for high-quality cannel, the supply of which is nearly exhausted. The several papers which have been contributed by members to this Institution on the various new processes proposed in substitution thereof have been of considerable help in the study of the subject. The author must confess that his interest in the matter has been stimulated by these means; and while he would have much preferred, before giving his experiences, having a more lengthy experience with the process he has adopted, the fact that he has been requested by the Council to do so, and the knowledge that the subject is of great interest and importance to the profession generally, are the reasons for this paper being given upon the Peebles process. Before proceeding with this, it may be worth while to deal briefly with the general subject of enrichment.

The gradual exhaustion of cannel, and the consequent rise in prices bringing about the increased cost of enrichment, have led to the consideration of the question whether or not it was desirable to enrich ordinary coal gas at all, and supply (say) 15-candle gas, and thus require the consumers to use a larger quantity, to get the necessary illumination. In considering this question, it has been usual to take the cost per candle per 1000 cubic feet delivered into the gasholder, which in the case of a 15-candle gas, after deducting residuals, might be taken at ½d. per candle, or 7½d. per 1000 cubic feet. If 15-candle gas, however, had to be enriched, each candle power added to such a gas has hitherto cost (say) from 1d. to 3d., according to the material and process used, situation of works, &c. Therefore each candle unit over 15 candles costs much more than that obtained from the coal alone; and at first sight it might appear better to be satisfied with the coal gas without enrichment.

A little further consideration, however, shows how false is such a view of the matter; for it is not the cost per unit of light delivered into the gasholder that has to be taken into account, but the cost delivered to the consumer. To illustrate this point, let it be supposed that 15-candle gas costs the consumer 2s. 6d. per 1000 cubic feet—that is 30d. for 15 candles, or 2d. per candle; the difference between this price and the cost of the same gas put into the holder being required to pay for storeage, distribution, and other fixed charges, and to provide a profit. These fixed charges would remain practically the same for all qualities of gas; so that any increased charge that would need to be made to the consumer would be the extra cost per candle per 1000 cubic feet delivered into the holder. If, therefore, the coal gas of 15-candle power could only be delivered to the consumer at 30d. per 1000 cubic feet, or 2d. per candle per 1000 cubic feet, and an enrichment could be obtained of which the cost did not exceed 1d. per candle per 1000 cubic feet, it would be greatly to the

interest of both the manufacturer and the consumer to have the 15-candle gas enriched. Especially would this be the case if it could be proved that the enriching can be done at less even than the penny above named.

Having come to the conclusion that it is desirable to enrich, there has next to be considered how far it would be desirable to carry the enriching. To fully develop the illuminating power of any gas, it is necessary to consume it under such conditions as will liberate, by its combustion, the contained carbon as far as possible in the solid form, and at the same time develop a large amount of heat; so that the carbon particles, as liberated, may be heated to a high temperature. The bringing about of these essential conditions in the flat-flame burner depends upon the pressure of the gas at the point of ignition, but in the Argand burner upon the velocity of the current of air in the chimney being just such as will lead to the introduction of the exact quantity of air required for the particular quality of gas being consumed. The lower the quality of the gas, the lower must be its pressure at the point of ignition, or the slower the air current in the Argand chimney; and if the quantity consumed be reduced, the pressure ought also to be reduced in proportion, or the rate of the air current. The poorer the gas, the more essential is it that these relationships should be maintained, as the least deviation leads to a very large percentage of loss in the possible illuminating power.

To develop to the full the illuminating power of 15-candle gas, it is necessary to consume it in an Argand burner of the best description. If gas which has given 15-candle power in the Argand burner be consumed with a flat-flame burner, it will only give about 12 candles illuminating power for 5 cubic feet. If the illuminating power of the coal gas be increased by enrichment, the difference shown by the two descriptions of burners is not so great; and if the enrichment be continued until the gas develops 19 to 20 candle power, the light given by the two burners properly used is practically the same, owing to the fact that the gas of the higher illuminating power can be allowed to issue at such a pressure from the orifice of the flat-flame burner as will give the flame sufficient stiffness, without at the same time inducing such a quantity of air as would lower its illuminating power. It is well known that the great bulk of illuminating gas is consumed in flat-flame burners, and it will therefore be evident that a high percentage of illuminating effect is lost with gas below 19 to 20 candles. This points then to the desirability of enriching up to that standard at least.

The higher qualities of gas—requiring as they do higher pressures, or quicker air currents, for their proper combustion—may have the conditions previously referred to varied through a considerable range without so seriously interfering with the development of their possible illuminating power; and if only ordinary flat-flame burners are used, the much stiffer flame resulting from the richer gas, being consumed at higher pressures (or in smaller burners), resists better the influence of side air currents. Consumers therefore obtain much greater efficiency from ordinary flat-flame burners when they are supplied with enriched gas than when these burners are used with coal gas which has not been enriched.

The poorer gas is undoubtedly suited for burning in regenerative lamps, as at present constructed. The number of these lamps is, however, comparatively few; and although the heating power of a richer gas may not be proportionately as high per unit of light as the low quality of gas, this slight loss, when the gas is used for heating purposes, is compensated for by the less vitiation of the air of a lighted room arising from the products of combustion.

Taking all these conditions into consideration, therefore, it would appear that, if coal gas can be enriched, at a cost per unit of light of half the price at which 15-candle gas is usually sold, it would leave a good margin of gain to both producer and consumer.

Satisfied that enrichment is desirable, even where it is not compulsory, the author has for some time past been on the alert to find the best method of obtaining enrichment in the simplest and most economical manner. All the new processes proposed have been carefully examined; and when the Peebles process was announced, it was in turn closely investigated, as it was evident that the process was a good one if it gave the result claimed for it—viz., that from a ton of shale oil 21,000 to 22,000 cubic feet of gas could be obtained equal to 90 candles for enrichment purposes. The method adopted, of setting forth the illuminating worth of the oil gas by means of its enrichment value, struck the author as being both ingenious and strictly correct.

After full consideration, and taking into account the evident honesty of purpose of those interested in the process, and the assurance given that there were large supplies of shale oil to be drawn from, and also the close proximity of St. Helens to Liverpool and Birkenhead, where there are boundless stores of suitable oils from the Russian and American oil-fields, the author determined, after working out statements from the figures published by the inventors, to recommend the Peebles process for adoption at the St. Helens works.

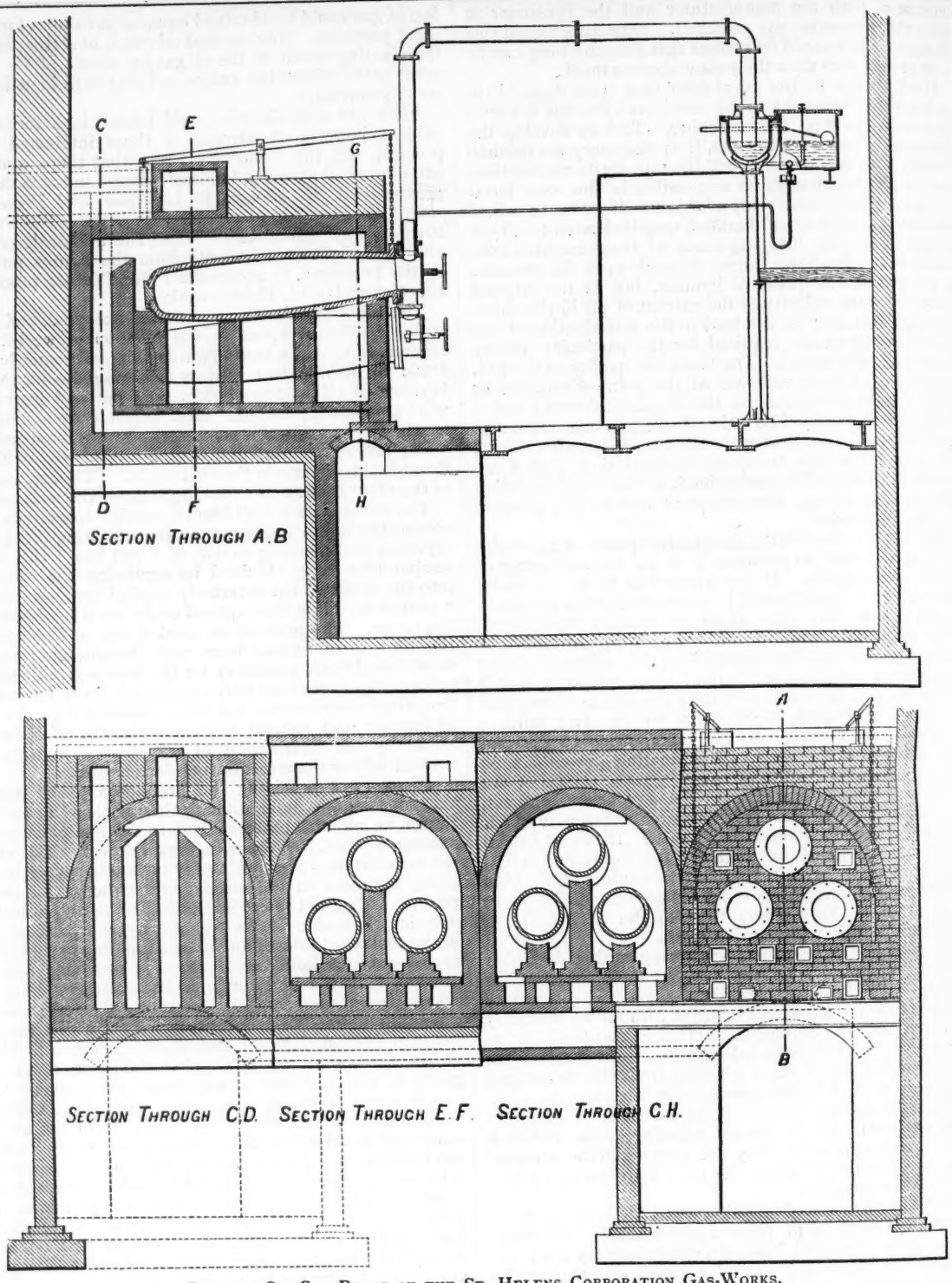
The recommendation was at once accepted, and £1000 authorized to be spent in the erection of works. The scheme, however, was afterwards enlarged somewhat, and made to include two railway tank-waggons for the conveyance of oil; a new photometer-room and instruments were also added; and the total expenditure amounted to nearly £1500. For this sum, works were erected and set to work, just as the stock of cannel was nearly exhausted through the dispute in the coal trade. [The arrangement of the plant is shown in the diagrams on the next page.]

The process, as is well known, consists essentially in decomposing liquid hydrocarbons by subjecting them to the repeated decomposing action of a red heat; the desired temperature being obtained by regulating the flow of oil into the retort to the externally applied heat, so that only a part of the oil is decomposed each time it passes through the retort. The process, as carried out at Peebles, bore the impress of having been well thought out; and the whole conditions necessary for the destructive distillation of liquid hydrocarbons fully considered, including not only the proper temperature, but the element of time, the effect of contact and radiant heat, and also the effect brought about by the inter-action of the various hydrocarbons present within the retort during decomposition.

The work of providing the first apparatus of this kind was considerably more difficult than it needs to be in the future, as all new patterns had to be made for retorts, ascension-pipes, mouthpieces, scrubber, &c. The cost of the installation was considerably increased owing to there being no room in the ordinary retort-house for the oil-retorts. A special retort-house had, therefore, to be built. The most suitable site for this was against the east gable of the coal retort-house; and there a building to contain four arches each to hold three retorts 9 feet long has been erected. On the north side is the railway siding, upon which the oil tank-waggons are received; and there they are emptied into an adjacent well, from which the oil is pumped into an elevated store-tank, capable of holding a stock of oil equal to 14 days' work in winter. The oil-pump is provided with a supplementary delivery, which can be used for giving a supply of fresh oil to the top of the scrubber as required. The outlet from the elevated store-tank is carried to the oil-feeding box in the corner of the retort-house, and the flow of fresh oil is controlled by a ball-cock, as it is only required to make up such quantity of oil as may have been converted into permanent gas; there being always a considerable quantity of oil flowing back to the retorts from the scrubber and condenser through the hydraulic main, to be conveyed back again to the retorts for further treatment.

The superficial area of each retort inside is about 46 square feet; and this, heated to the right temperature, is capable of producing upwards of 10,000 cubic feet per 24 hours, or, in other words, gasifying 118 gallons of oil in that time. The gas-making capacity of the retorts may be varied over a wide range. The production may be increased considerably beyond the power above stated, if the temperature and oil-feed are both increased in correct proportion, or the production may be decreased when desirable by reducing the temperature; and the lower the temperature employed, the greater is the enriching value per gallon of oil. The author's actual experience is confined to a mixture of oil two-thirds blue shale of about ·885 sp. gr. from Scotland, and one-third petroleum oil, (American and Russian), about ·825 sp. gr.; and the working results have been upwards of 22,000 cubic feet of gas per ton of oil, having an enriching value of more than 90 candles.

The only thing which interferes with these results being



PEEBLES OIL-GAS PLANT AT THE ST. HELENS CORPORATION GAS-WORKS.

obtained is bad management of the oil-retorts, bringing about a combination of high heats and slow feed of oil. The quality of the gas varies to some extent with the production; or a sudden sharp frost may cause the oil in the scrubber to have a greater scrubbing effect on the gas. This would, however, only be a temporary disturbance, and could soon be counterbalanced by making a slightly larger quantity for the time being.

The figures given in this paper have been carefully checked from results obtained month by month since the process was put to work in November last year, from which time it has been the only method of enriching at St. Helens. The first setting of three retorts is now doing all the work. There have been only two stoppages since the plant was started, upon each occasion to repair a defective oil-valve; and within a quarter of an hour after the completion of the repairs, the retorts were in full work again.

Warned by those who did not know the peculiar success of the Peebles process, to expect choking up of the ascension-pipes, hydraulic mains, and condensers, operations were conducted with great care at first, for the purpose of training the workmen who were to take charge of the plant, and to whom the theory of the process had been previously explained; it being an essential condition of success that it should not require the constant supervision of a chemical engineer to secure satisfactory results. The theory was gradually proved by practice by ordinary stokers; and they have in a very short time so grasped the very simple details, that stopped ascension-pipes can be entirely avoided. The heating, feeding, drawing, and cleaning of the retorts is performed in such an easy, simple, and economical manner, that it stamps the process at once as an ideal one for all ordinary works.

The only real difficulties that have been experienced in connection with the process are two, both of which have

been overcome. One is a tendency of the retorts to crack on the under side, owing to the oil as it runs into the retort causing a sudden shrinkage of that part. So far, no difficulty has been experienced in making up these fractures by pointing them with a mixture of salt and fire-clay; and the retorts which were started in November last are still at work, and from all appearances will continue to work for some time. It is expected that a quality of iron will be found which will stand this work better; or some mechanical device may be adopted which will altogether prevent the cracking. The other difficulty arises from the occasional accumulation of volatile hydrocarbons. These hydrocarbons, although very volatile, are apparently difficult to decompose; and they go on circulating through the retort and condensing apparatus, thereby impeding the production of permanent gas. This has been entirely overcome by introducing coal gas into the hydraulic main of the oil-retorts. The introduction of a poor gas enables the volatile hydrocarbons to be taken up by their diffusion, and carried forward along with the permanent gas.

The working condition of the retorts can, after a little experience, be readily known by examining the rate of flow of oil in relation to the temperature of the retorts; and this can be checked by ascertaining the colour of the gas in the retort—each lid being provided with a tap. If the colour of the gas is blue, this proves that too much oil is being admitted. The flow of oil should be carefully reduced until the colour of the gas is canary or lemon colour, when it may be concluded that the right proportion of permanent gas and oil vapour is leaving the retort together. A short experience, however, enables the workmen to know by the heat of the retorts the size of oil-feed required. The invariable rule is to feed the retort for ten hours, then shut the oil-feed and carbonize the residue for two hours, and thus complete a charge, so to speak, every twelve hours. In this time a layer of coke about 3 inches thick is formed on the floor of the retort; and this is easily removed with a rake in the ordinary way.

The several settings of retorts are heated from one producer; the fuel used being a mixture of coke and coke screenings. The producer is fitted with closed doors, and supplied with its primary air under pressure by a jet of steam. The producer gas and the secondary air are conducted to the back of the setting, where combustion is allowed to take place above the top of the retorts. The heat travels downwards through the settings, and is carried away in flues which run alongside the air-inlet flues, forming a simple arrangement of regenerator.

The setting is a simple arrangement, giving the necessary support to the retorts, and allowing of every access to the exterior of them, so that their surfaces may be cleaned from the accumulation of dirt and ash which gradually gathers upon them, and would interfere with the heating if not periodically removed. As the size of these retorts is an especially important feature, they should be carefully worked, so as to prevent the production of hard carbon; but periodically scraping the whole interior with the drawing-rake is an easy and effective precaution to take, as it removes the foundation of the solid carbon formation. When, however, these retorts are properly heated and worked, there is really very little carbon formed. Even the tendency to form a sort of stalactite round about the bottom of the ascension-pipe within the mouthpiece is gradually overcome by careful working; while the ascension-pipe is quite easily maintained in such a condition that it sounds as clear as a bell whenever it is struck. The simplest and most effective way to remove whatever carbon is formed within the retort is just the same as that adopted in scurfing ordinary clay retorts. Luted lids should be used, as these retorts work very well without an exhauster.

If it is considered advisable, the gas after condensation and purification can be stored by itself in a holder of sufficient capacity to contain a reserve stock, which could be drawn upon as required for enriching the coal gas on its way to the holders. The practice at St. Helens is to make such quantity as is required regularly day by day, purify it from its trace of sulphuretted hydrogen, measure it by a separate meter, and then present it to the coal gas at the inlet of the station meter. It has been found that this method of mixing the two gases is at once simple and effective.

The oil gas made by the Peebles process can be quite freed from all the condensable constituents which accompany it as it leaves the retorts; or, in other words, the finished gas can be made to consist entirely of permanently gaseous rich hydrocarbons. Since the oil-gas plant was started, no trace of oil has been found after the two gases are mixed; and it is expected that less difficulty will be experienced in future with naphthalene deposits in the street mains and service pipes.

The illuminating power of the oil gas, when tested in a No. 00 union-jet burner at the rate of 1½ cubic feet per hour, works out to about 60 candles on an average for 5 cubic feet. But it will be readily granted that it is impossible to find the full value of the gas unless it is mixed with a diluent combustible gas; and coal gas is found to be the best. The composition of the coal gas will, no doubt, influence in some degree the enriching effect of a certain quality of oil gas. The author's experience is limited, owing to the short time the process has been in operation; but there is reason for belief that coal gas of an illuminating power of 15 candles, produced at extremely high heats, is less enriched by the same percentage of oil gas than a coal gas of the same illuminating power produced from coal, which could be properly carbonized by lower heats—this being due, in all probability, to the larger quantity of marsh gas present in the gas produced at the lower temperature.

The coal worked during the last five months at St. Helens has been of the cheapest quality required to be carbonized in retorts maintained at a high temperature; the average illuminating power of the coal gas having been 15 candles, and the percentage of oil gas 4·8. Taking the oil gas as having an enriching value of 90 candles, as claimed by its advocates, there should be obtained the following result:—

95·2 per cent. of	15-candle gas	14,280 candles.
4·8 ,,	90 ,, ...	4,320 ,,
	Total	18,600 candles.

The average, however, of 121 tests taken in the most careful manner from the street mains (only one test being taken on any day) gives 18·91 candles corrected; proving the oil gas to have had an enriching value of about 96 candles.

The total make of gas at St. Helens is 225 million cubic feet per annum. The Committee require the gas to be carefully purified; and although the Act of Parliament controlling the original Company only stipulated for 14-candle gas, the Corporation have, since the works came into their hands, always instructed their Engineer to make as near 19-candle gas as possible. The gas is not only tested very carefully daily at the works for the guidance of those in charge of the operations, but one of the most modern photometers has been provided by the Gas Committee, and fitted up at the Town Hall; and this photometer is used at frequent and irregular times for checking the quality of the gas supplied. This instrument is in charge of the Borough Analyst, who reports to the Gas Committee the results of his testings; and these have been practically identical with those taken at the works. Standard candles are used; and every care is exercised to secure reliable tests. If, then, this quality of gas can be manufactured by a simple process at an economical price per 1000 cubic feet, the question as to how enrichment is to be provided in the future is answered. The cost per 1000 cubic feet of oil gas manufactured by the Peebles process when working on a small scale, and using only 1 ton of oil per day, has been found to be as follows:—

1 ton of oil at works . . .	£3	7	6	producing 22,000 cubic feet
Royalty	0	2	6	of 96-candle gas.
Labour	0	3	0	
Fuel	0	5	0	
	£3	18	0	
Less value of coke per ton .	0	5	0	
	£3	13	0	

This is equal to 40d. per 1000 cubic feet nearly. There is therefore a considerable margin to provide for interest on capital and renewals to bring up the cost of 96-candle gas to ½d. per candle; and oil will be obtained at many works at a much lower figure than that given above.

With this process available, the illuminating power to be applied is no longer limited to a few candles; and a standard can be maintained far in excess of that obtainable from the great majority of cannels, and certainly far higher than it would be safe to go by the introduction of gas containing condensable hydrocarbons. The objection taken to enrichment, that there is a fear that the

higher qualities of gas would be more liable to condense, does not apply, therefore, to the gas produced by the Peebles process, as it is a perfectly permanent gas, differing in a most important feature from other modes of enrichment, and ensuring that whatever enrichment is put into the gas at the works is delivered to the consumer at the utmost limits of supply. Further, there is no longer any doubt as to whether heavy crude oil can be successfully gasified, and its ungasifiable carbon deposited in a valuable form inside the retorts.

Hydrocarbons containing a large excess of carbon over what can be gasified by destructive distillation had not been successfully worked previous to the invention of the Peebles process, owing to the fact that such carbon was deposited in the condensing, &c., apparatus, and choked them up; whereas by the Peebles process such excess of carbon is deposited in a hard and marketable form inside the retort as coke, occasioning no inconveniene, as it is as readily withdrawn as ordinary gas coke, and has a value at least twice that of ordinary coke, owing to its hardness and freedom from ash and sulphur compound.

The merits of the process are :—

(1) The plant is an exceedingly simple one, and can be erected at a small cost and successfully operated by the ordinary workmen of a gas-works.

(2) It produces a permanent gas of great value as an enriching agent. The gas being made quickly and easily, it gives a ready means of controlling the illuminating power; and the actual work done by each gallon of oil used can be accurately ascertained.

(3) The range of oils suitable for gas making by this process is greatly increased. The crudest oil can be completely resolved into gas and good hard coke.

(4) The enriching gases produced are mixed with the gas to be enriched in such a way that the highest duty is obtained from both the coal gas and the enriching gas.

(5) Enrichment is provided at such a cost as to enable companies and corporations to supply a high candle power gas as cheap, if not cheaper, per unit of light, than it is usually done by a low quality of gas.

The author is therefore led to the conclusion that the Peebles process has a great future before it.

THE INTRODUCTION, DEVELOPMENT, AND PRACTICAL WORKING OF THE OXY-OIL GAS PROCESS AT THE HUDDERSFIELD GAS-WORKS.

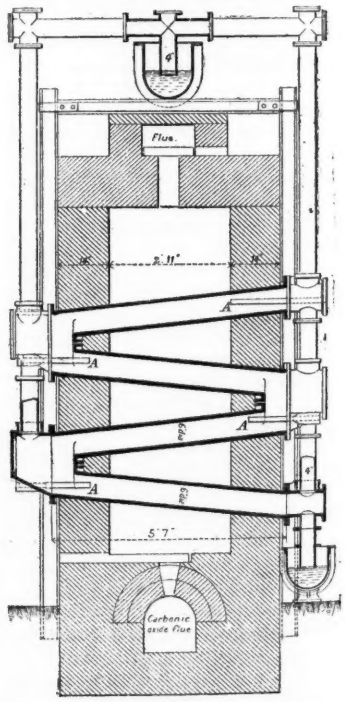
By W. R. Herring.

The subject of gas enrichment, a particular branch of which the author has the honour of bringing under the notice of this Institution, is one of such considerable interest and far-reaching importance, that he feels an apology is due to the members for the incomplete nature of the matter he is able to place before them; but, owing to his engagement upon an extensive reconstruction of works scheme, circumstances have been such as to prevent more time being spent upon experimental and research work than was sufficient to ensure the successful practical working of what may be termed a new departure in gas-enriching processes. This has become generally known as the "oxy-oil process;" and it consists essentially in the admixture of definite percentages of free oxygen with the resulting heavy hydrocarbon gases produced by retorting crude or heavy-grade oils at a low temperature—the admixture being made when the oil gas is still hot, by which means a considerable quantity of heavy hydrocarbon vapours are sustained in a permanently gaseous state, which otherwise would condense and be lost as illuminating agents.

This process was first brought under the notice of gas engineers by Dr. Thorne, in a paper published by The Gas Institute in 1890. Early in 1891, the attention of the Huddersfield Gas Committee was drawn to the process by the patentee and the English representative of the Syndicate owning the patents, who had erected an experimental plant at a doctor's house in Huddersfield, where the patentee demonstrated, in the presence of the late Engineer of the Corporation, the practicability of producing a mixture of two such gases without danger, and, as far as could be seen, with considerable advantage from a gas manufacturer's point of view. The Gas Committee were invited to inspect the plant; and they were so much impressed by the demonstration, that it was resolved to give the process a practical trial, on a moderate scale of working, at the Huddersfield Gas-Works, with a view of employing the gas as an enriching agent in lieu of cannel.

With this object in view, negotiations were entered into with the Northern Counties Company's agents, with a view of settling terms upon which a license for the use of the patents might be arranged. These negotiations were very much protracted, from various causes; and they were not finally signed until April 6, 1892. It was about a month previous to this date that the author was appointed to take charge of the Huddersfield Gas-Works; and he then, for the first time, learned that plant for carrying out the process was to be put down. He was, however, unable to discover any information or particulars at the works as to the form the plant was to take for retorting the oils, although detail drawings and particulars of the oxygen plant were there, and the work was in hand.

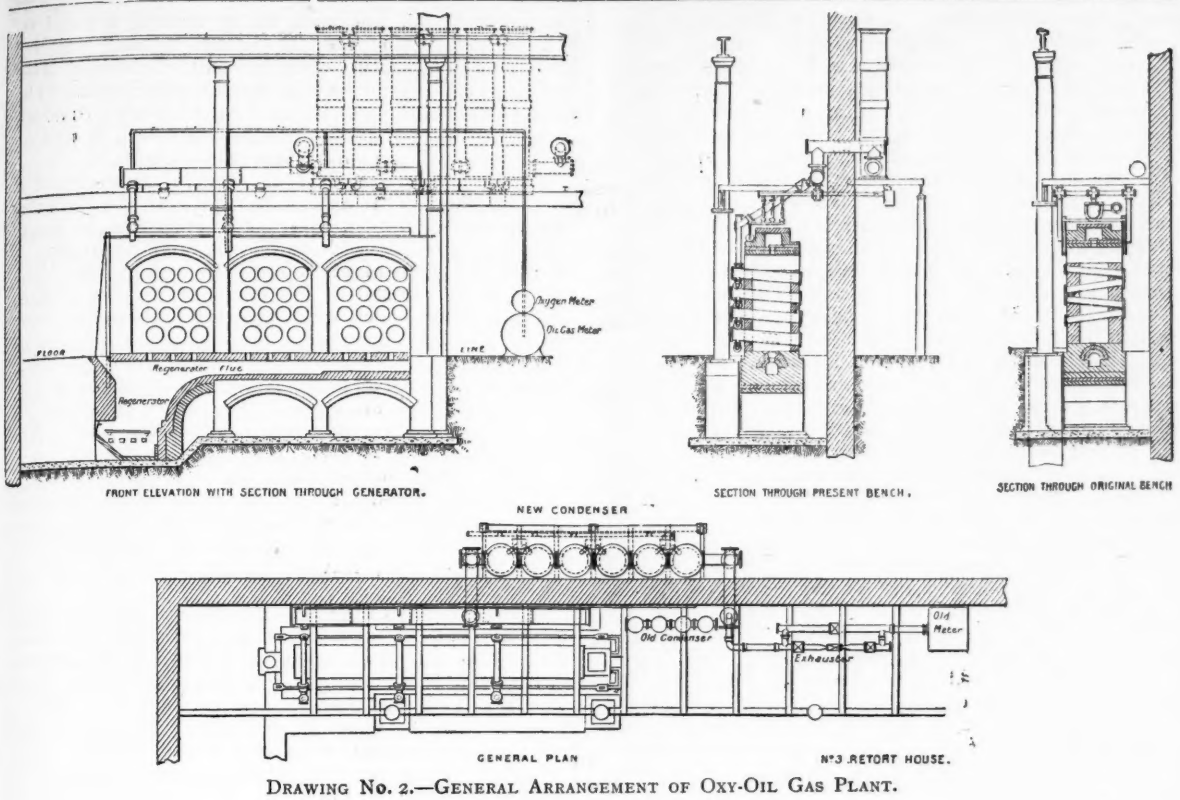
During May, 1892, a communication was received from the Northern Counties Company, in which it was stated that they were prepared to exhibit the production of oxy-oil gas upon a manufacturing scale of working; and they invited the author to visit their Great Malborough Street works in Manchester to inspect the plant, and make any investigation he might think fit. On the 26th of May, 1892, the author visited the experimental works in Manchester; and he was disappointed to find the plant to be on a very small scale, and, as far as the actual producing portion was concerned, of a very crude form indeed—so much so, in fact, that he was compelled to condemn it for practical working, as he did not consider himself justified in multiplying it for the scale of working it was intended to carry out at Huddersfield. The results of the experiments which the author obtained with this plant, however, gave very great promise of success; but there is always such a wide gulf between results obtained by experiments of this nature (what with short runs and clean apparatus, &c.) and the results of the same when subjected to practical working conditions, that the author's report upon his investigations was drawn in extremely cautious terms, not, however, without hope of ultimate success.



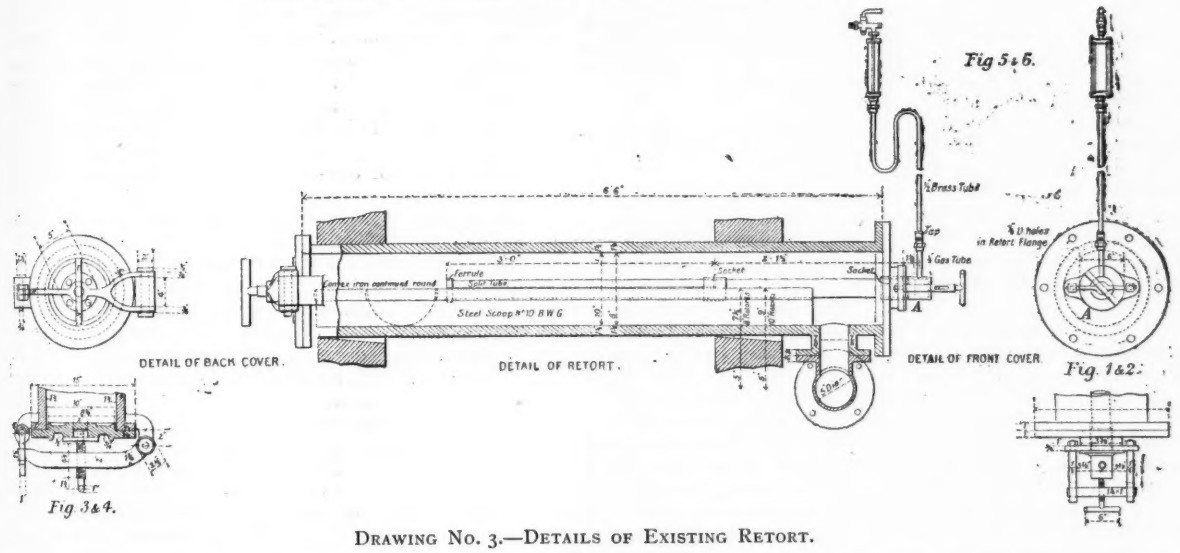
A.—Oil-feed tube.

Drawing No. 1.—Details of First Installation.

During July of the same year, the Manager of the Company submitted to the author a design of an entirely new form of retort which had been provisionally protected by the Company, and shown on diagram No. 1. This appeared to possess points of novelty; and the author suggested



DRAWING No. 2.—GENERAL ARRANGEMENT OF OXY-OIL GAS PLANT.



DRAWING No. 3.—DETAILS OF EXISTING RETORT.

that a retort of this design should be put down at the Manchester experimental works. This was done as quickly as possible. Another visit of inspection was paid in November of the same year; and some further investigations were carried out with the new retort. The results obtained therewith were sufficiently promising to warrant the author in advising his Committee to proceed with the erection of a portion of the plant at Huddersfield. With this object in view, a letter was sent to the Northern Counties Company asking them for detailed drawings and particulars of the plant they suggested being put down to produce the oxygenated oil gas; and, in reply thereto, a set of blue prints were received from the Company, on which were shown the general arrangement and details of the plant to be put down at Huddersfield for the production of 200,000 cubic feet per diem.*

The author did not consider it wise to adopt the arrangements shown on these prints, for reasons which many will appreciate upon examining them. He was not, however, prepared to take all the responsibility upon himself for the success or the failure of the process; so, after due consideration, it was determined to adopt the form of retort which the Company had patented, and make other arrangements as regards the general design of the whole plant. This resulted in the arrangement shown on diagram No. 2. It was decided to erect the bench in one corner of a retort-house, beneath an overhead stage, intended at some time to be used for the delivery of coal into the retort-house; but as there was no possibility of such being the case, it was felt that this position was most convenient, as all apparatus—such as condenser, exhauster, &c.—could be erected upon this stage out of the way of the ordinary retort-house operations.

The design, briefly described, consists of three arches of brickwork, 7 ft. 9 in. by 8 ft. high, and 5 ft. 3 in. from the front to the back. At one end a simple generator furnace was provided, with a carbonic oxide gas flue passing underneath the three settings, with dampers arranged so that any one or all three of the settings might be worked together. The exit flue is on the top of the bench; there being two dampers to each setting. One of these settings was first equipped with six retorts of the design shown on diagram No. 1, with ascension-pipes back and front, together with an ordinary hydraulic main and dip-pipes. The plant was finished in June, 1893, and put to work after the customary delays inseparable from

* The prints referred to, which had been carefully mounted, were in the room for inspection by the members.

starting any new process. To be brief, however, it must be admitted that the setting was a failure, although it was not recognized as such until some weeks of fruitless endeavour had been devoted to attempting to make it work successfully and continuously. During these many trials, however, some valuable information was obtained as to the principles of the process itself, which were certainly encouraging, and justified the author in determining to try again. The chief cause of the failure was owing to the form of retorts used not permitting of expansion without springing some or other of the many joints, which consequently allowed gas or oil to escape outwardly, or the admission of air to the gas produced. The failure of the first setting resulted in the production of an entirely different design of retorts, which with as little delay as possible were made and prepared for work. On diagram No. 3 is shown the detail of the new retort, made of cast iron, 6 ft. 6 in. long from flange to flange. The front has a flange cover bolted thereto, through which the oil feed-pipe passes, and to which it is secured by means of luting and a cross-bar, screw and lugs, shown at A, figs. 1 and 2. The back portion of the retort is fitted with a hinged cover and screw, as shown at B, figs. 3 and 4.

The retorts are arranged in groups of fifteen per setting, in four tiers; the three upper rows being of four each, and the bottom row of three. The twelve upper retorts are 8 inches in diameter; and the lower three, which are used for cracking the heavy residuals, 10 inches in diameter. The retorts incline to the back, and have 3 ft. 9 in. of their length exposed to the heat. The oil is fed into the retorts by means of 2-inch tubes passing through the front covers, and extending a distance of 3 feet along the heated portion of the retort. This length of the feed-tube is split longitudinally, and the upper half secured by two loose-fitting collars. The tubes are fixed in the retorts in the manner already described; and when they require cleaning, a union on the ½-inch oil-pipe is disconnected, and the tube withdrawn and replaced by a duplicate, which is put into position, coupled up, and the retort set to work again after standing only a few minutes. The collars from the choked tube are then knocked off, and the carbon removed from the tube. It is from this source that the bulk of the carbon is obtained.

The oil is supplied to the feed-pipes by specially-constructed sight feed-syphons (figs. 5 and 6 on drawing No. 3), by means of which the oil-flow is protected from draughts and dust, and also prevented from overflowing when the feed-pipe becomes choked; the oil simply rising and filling the glass, which indicates that the particular pipe to which it is attached requires clearing. Each row of retorts can be shut off from the remainder by means of a valve, to enable the interchange of oil feed-tubes without interrupting the continuity of the work of the whole bench; the gas from each row discharging into one ascension-pipe common to each setting, at the top of which the oxygen is admitted. The admission of oxygen is proportioned by a specially-constructed meter, coupled by means of chain and wheel gear to, and consequently governed by, the oxy-oil station meter; the proportion of oxygen admitted being adjusted to any definite percentage by means of change-wheels. The author has found 15 per cent. to be the most suitable for the production of an enriching gas with the class of oil he is now using, of ·878 sp. gr.

The collective arrangements of oil feeding to the various rows of retorts are as follows: The two upper rows in each bay are fed with fresh oil in such quantity (depending upon the heat, which should be maintained at a dull red) as to yield a canary-coloured gas. The third row is supplied automatically with the light oils from the condenser, supplemented by fresh oil. The bottom row is fed with the heavy oils and tar collected in the seal-cups of the ascension-pipes, which is conducted automatically to a tank on a lower level, and pumped into a feed-tank on the stage.

The gas immediately on leaving the retorts passes up the one ascension-pipe common to each setting, where it discharges into a collecting-main, from which it is conducted to the condenser-inlet; the condenser being fixed level with the upper stage, but on the outside of the retort-house wall. After condensation, the gas passes through the meter direct. When the admixture is being made in the foul main, or when enriching at the meter-inlet, it passes first through the exhauster and then through the meter.

When originally designing the general arrangement of the plant, the author made provision to admit the enriching gas either at the foul main or by working a small exhauster, and passing the gas through a small weighted holder. The admixture could be made at the inlet of the station meter—a point which theoretically appears to be the correct one, though practically the advantages do not compensate for the additional trouble involved in working an exhauster when a small plant is in question.

Having briefly described the general arrangement of the plant, there yet remains to be dealt with the all-important question of results. But before proceeding to supply these, it may be advisable to give a brief description of the capacity of the plant at present existing at Huddersfield. As already stated, the oil plant consists of three bays or settings, each of 15 retorts; each setting being capable of cracking one ton of oil per diem, which is equal to an average yield of about 85,000 cubic feet of gas daily. The plant is attached to the No. 3 section of the works, which is equal to a total output of 2,500,000 cubic feet per day. It is, therefore, possible to admit 3·4 per cent. of the oxy-oil gas to the total production on this section of the works. As a matter of fact, about 2½ per cent. is now being admitted; and for the immediate future, and until greater progress has been made with the general reconstruction of the works, this quantity will be maintained. This will, therefore, leave a margin of 26 per cent. to work upon.

In connection with the new retort-house now in course of construction, a complete oxy-oil gas-works is also being arranged, of such proportion as to allow of the present requirements being met, together with provision for future extension. At one time it was intended to supply a 20-candle gas; but so much satisfaction has been expressed with the 18½-candle gas which has been supplied for some time past, both as regards cleanliness and lighting effect, that it seems useless to raise the illuminating power to a higher standard. There is no doubt that 18½-candle gas produced by enrichment with oxy-oil gas gives a much greater apparent lighting effect than a gas of equal photometrical value produced by enriching with either oil gas or cannel. The oxy-oil enriched gas yields a steady, rigid, and white flame. This fact has, therefore, resulted in a modification of the original idea, which was to produce a sufficient quantity of oxy-oil gas to admit 5 per cent. to the maximum make of from 3¾ to 4 million cubic feet a day, and produce a 20-candle gas. For the present, however, it is intended to supply an 18½-candle gas.

With regard to the practical working of the plant, there is very little trouble indeed, so far as difficulties are concerned, excepting when the heats are allowed to get too high. The whole secret of successfully making gas from liquid hydrocarbons depends upon the degree of the heat applied, combined with its method of application; and the author's experience is that a comparatively slight increase or decrease of heat makes a difference in the quantity and quality of the resulting products out of all proportion with the extent of the change of heat. It is, however, worthy of note that the result in candle-feet yielded per ton of oil used remains fairly constant, notwithstanding the variations of heat, provided these are not allowed to range too far. Under ordinary conditions of working, there is not so much trouble as many experience with stopped ascension-pipes.

The process has been in continuous work at Huddersfield for the past eight months; and a total quantity of upwards of 3,500,000 cubic feet of gas has been made and employed as an enriching agent during this period—entirely supplanting cannel upon the No. 3 section of the works. In order to give a fair statement of the results obtained during the past winter, it will be necessary to leave out of consideration the period up to the beginning of December last, as, owing to the coal strike, the supply of coal was partially from Durham and partially from the South Yorkshire district, and the proportions of each description used from day to day varied very considerably. It would, therefore, be very difficult to say what was the initial illuminating power of the coal gas, as it was not convenient to have an assistant in the laboratory day by day to ascertain it. It was the practical effect of the enricher that was all-important at this particular time; and as this was satisfactory, investigations as to the why and wherefore were deferred until a less busy season.

Taking, therefore, the months of December, January, February, and March, the results obtained on the No. 3 section of the works during this period have been as

follows, with the oxy-oil gas passing into the bulk at the coal-gas condenser inlet, and consequently through the whole of the purifying plant, into which a percentage of oxygen, either pure or as air, was admitted :—

Coal gas made with enriched gas, in bulk . .	139,526,300 cub. ft.
Average illuminating power, as tested on standard photometer (Board of Trade stamped No. 257) against Methven screen	18·12 candles.
Oxy-oil gas made, containing 15 p.ct. of oxygen	1,810,610 cub. ft.
Percentage of enriching gas in bulk	1·29 candles.
Do. do. added to bulk. .	1·31 per cent.

During this period the illuminating power of the coal gas before enrichment was frequently ascertained by admitting the oxy-oil gas at the station-meter inlet for an hour or two at a time.

In the four months under consideration, the average results yielded a gas of 16·83-candle power without enrichment. This is a higher candle power than is subsequently given in the results of the experimental work carried out during April for the purpose of this paper. It is, however, correct, as during the earlier period the average production per ton of coal was 10,094 cubic feet ; whereas during April the production was increased to an average of 10,656 cubic feet of 16-candle power gas. The foot-candles produced per ton of coal during the two periods are respectively as follows : 33,976 and 34,099, after deducting the percentage of enriching gas from the make of each period. The author's reason for obtaining the smaller yield per ton of coal during the winter months was simply to maintain the illuminating power of the gas ; as, owing to the larger make, and to the fact of the installation of the oxy-oil plant being incomplete, the only alternative was a poorer gas, which, in his opinion, it was not expedient to supply. These results have, therefore, yielded an increase of 1·29 candles for the addition of 1·31 per cent. of enriching gas, or a gain of 0·98 of a candle per cent. of enriching gas added.

The cost of enrichment per candle during the period under consideration is given in the following statement, which, however, includes items not fairly chargeable to the process, as well as the fact of the labour being in excess, owing to the small production per day. It is, however, better to overstate than to underrate such items when dealing with the large interests to which this process is intended to apply :—

Statement of the Cost of Enriching 137,715,690 *Cubic Feet of* 16·83-*Candle Coal Gas to the extent of* 1·29 *Candles during December*, 1893, *and January, February, and March*, 1894.

Oil used, 66 tons, at 67s. 6d. per ton	£222	15	0
Oxygen, 271,590 cub. ft., at 4s. 6d. per 1000 cub. ft. .	61	2	0
Labour, 12s. per day, 121 days	72	12	0
Fuel, 15 cwt. per day, 121 days	22	15	0
Interest and sinking fund on—			
Plant, four months, at 4½ per cent. on £500 .	7	0	0
Wear and tear on ditto, four months. . . .	10	0	0
	£396	4	0
Royalties	22	12	6
Total	£418	16	6

Coke produced, 2 tons 15 cwt. = 4 per cent. on the weight of oil.

The number of candles added to the bulk of gas in thousands of cubic feet was 179,988 ; so that the cost per candle-thousand, including all charges, equals 0·52d. per candle of enrichment.

As will be seen from the above, the cost of the oxygen represents upwards of 14 per cent. of the total enrichment ; but, as is subsequently explained, for this additional 14 per cent. in the cost of producing the enriching gas, a gain of 40 per cent. is obtained from the oil used. The cost of oxygen can, however, in the author's opinion, be very materially reduced by utilizing the waste heat from the coal carbonizing plant. The heat leaving the regenerator settings would be sufficient for this, supplemented by a separate generator for use when waste heat is not available. This would not only save the cost of the fuel, but it would also do away with the labour in connection therewith, which is the chief item in the working expenses. In fact, if this arrangement had been carried out at Huddersfield, the only labour entailed in working the oxygen plant would have been in connection with charging and emptying the purifiers, which does not occur, on an average, more often than once a month. The vacuum and compression pumps being in the exhauster-house, the one attendant could with ease attend to the working of these.

For the purpose of this paper, the author conducted during April last some large-scale experiments, with a view of ascertaining the effect of the oxygen upon the production of oil gas in general. It is, however, such a large subject, and of such a peculiar nature, that his opportunities have only enabled him to ascertain the bare facts, which, however, are somewhat startling ; and he does not profess to be able to explain them further than that the experiments have been very carefully conducted, and he sees no reason to doubt their accuracy. With this object in view, preparations were made for a few days' run with oil alone, and without the admixture of any oxygen with the resulting gases ; the whole plant being stopped for a few hours previously to beginning the test, in order to start clean, and to remove all carbon from the feed-pipes and retorts, so as to ascertain the amount of solid residue left after retorting the oil.

The gas produced during the experiment, together with the coal gas, was admitted to one particular gasholder, which rose to a total height of 72 feet above the water-line, and contained 934,000 cubic feet of gas. No other gas was mixed with this ; and, after standing for six hours, at 6 p.m. this particular holder was put on for the town's supply, and photometrical observations taken every five minutes until 10 p.m., both on the works and on the district photometer, which is about 1½ miles from the works. When shut off, 225,000 cubic feet of gas remained in the holder ; and this was tested out on the following evening. The experiment lasted over a period of 24 hours, during which time 934,000 cubic feet of gas were produced from the coal and oil combined ; the production being at the rate of 10,803 cubic feet per ton of coal.

During the 24 hours of this test, the yield of gas from the oil was very small—amounting only to 14,080 cubic feet from 17 cwt. of oil, which is equal to 16,560 cubic feet per ton. As far as was known, the heat was the same as usual at starting ; but it was found necessary to employ more retorts, to crack the residuals as produced, than was customary when using oxygen. Subsequent experiments have, however, thrown some light upon this point. When cracking oil without oxygen, the average make per ton of oil has been 20,430 cubic feet of 58-candle gas, which is equal to 236,988 candle-feet per ton of oil. The average production per ton of oil during the four winter months, with 15 per cent. of oxygen, equals 27,433 cubic feet of 70-candle gas, or 384,062 candle-feet per ton. This greater yield of gas when using oxygen appears very mysterious, and is at present inexplicable on scientific grounds. This fact, however, led the author to conclude that a greater quantity of residual had been returning to the retorts during the first oil experiment than was usual when using oxygen, a proof of which was the necessity of employing more retorts for residuals, and less for fresh oil.

This frequent return of the residuals naturally reduced the heats, without its being discovered until too late to attempt to alter the experimental run. The 17 cwt. of oil used yielded 14,080 cubic feet of gas, which was equal to 1·5 per cent. of the total production. For this 1·5 per cent. of oil gas (illuminating power not ascertained), an increase of 1·54 candles was yielded in the bulk of gas put into the holder. After standing in the holder for six hours, the gas was turned on for the town's supply at 6 p.m., and photometrical observations were taken every five minutes until 10 p.m., both at the works and on the district photometer, about 1½ miles from the works. When shut off, 225,000 cubic feet of gas remained in the holder ; and this was tested out on the next evening. The following statement summarizes the results of this batch of oil-enriched gas from beginning to end :—

Statement giving Results of the Permanency of 934,000 *Cubic Feet of Oil-Enriched Gas put into a Gasholder during* 24 *Hours' Work, and Tested Out until Empty, after standing* (*A*) 6 *Hours, and a portion* (*B*) 6 *Hours on one Day, and* 20 *Hours following.*

[Average quality of gas put into holder, 17·54 candles.]

Time.	Works Photometer.	Time.	District Photometer
	Candles.		Candles.
7.0 to 8.0 p.m.	17·05		
8.30 „ 9.25 „	16·82	8.30 to 9.30 p.m.	15·69
9.30 „ 10.5 „	16·60	9.30 „ 10.30 „	15·86
Next day—			
6.0 to 7.0 p.m.	16·55	6.30 to 7.30 p.m.	15·69
7.0 „ 8.0 „	16·57	7.30 „ 8.30 „	15·69
	5)83·59		4)62·93
Average	16·72	Average	15·73

These results are very interesting when closely examined. In the first place, the enriching effect of the oil gas was extremely good at the station-meter outlet; being, practically speaking, 1 candle per cent. of enriching gas added. After the bulk had been allowed to stand, however, for a period of six hours and was then tested, the enriching effect had fallen from 1 candle to 0·7 candle per cent. of enricher. The quality of the bulk continued to fall uniformly from hour to hour; the last being 16·6 candles. This, practically speaking, was the limit of fall, as on the following evening the readings were 16·55 and 16·57 candles. The average enriching result obtained at the holder outlet from this batch of 17·54-candle gas put into the holder was equal to 0·48 candle per cent. of oil gas.

With regard to the travelling powers or permanency of this particular batch of gas during distribution, some further interesting results were obtained. The gas which left the works between 8.30 and 9.25 p.m. at 16·82-candle power, yielded only 15·69 candles on the district photometer; the latter quality remaining practically constant during both days. On the day previous to these tests being made, the permanency of oxy-oil enriched gas during distribution had been carefully examined, with the result that practically no difference could be detected between the works and the district photometer, after making the usual correction, as well as for the difference in altitude, which was done in all cases. Nothing whatever was done to either photometer between these tests with oxy-oil enriched gas and with oil enriched gas. It is, therefore, only fair to accept them as reliable tests.

Not feeling altogether satisfied with the preceding test, on account of the small make and the unstable character of the resulting gas, the author determined to again work the plant for oil gas alone; and before starting he had the heats raised slightly above the customary extent. A total quantity of 74 cwt. of oil was used upon two separate experiments; and the following is a summary of the results:—

Oil used	74 cwt.
Gas per ton	20,430 c. ft., of 58 c.p.
Combined gas produced	3,239,000 cubic feet.
Coal gas	3,163.409 ,,
Oil gas	75.591 ,,
Percentage of oil gas added	2·38 per cent.
Oil gas	2·33 ,,
Average illuminating power of coal gas	16·00 candles.
Do. do. enriched gas	17·83 ,,
Enriching effect of oil gas	0·76 per cent.
Coke residual equal	6·30 ,,
Candles added per 1000 cubic feet	5929

From the foregoing results, some useful comparisons can be made as between oxy-oil gas enrichment and simple oil-gas enrichment, in which the benefits of using oxygen in connection with the production of an enriching gas from liquid hydrocarbons are strikingly demonstrated. Taking the cost of oil used per candle of enrichment in either process, the result with oil at 67s. 6d. per ton is—

Average cost of oil only, per candle of enrichment during December, January, February, and March, oxy-oil process, illuminating power yielded *out* of holders.	0·29d. per candle-thousand.
Average cost of oil per candle of enrichment from experiments with same plant without using oxygen, but working a slightly higher heat, and taking illuminating power put *into* holder.	0·49d. per candle-thousand.

This shows an advantage of 40 per cent. in the economy of oil when oxygen is used in conjunction therewith, from which must be deducted the cost of the oxygen, which equals 0·08d. per candle-thousand; resulting in a net gain in favour of the oxygenated oil-gas process, as against simple oil gas, of 24 per cent.

The foregoing result is arrived at on the assumption that the simple oil-gas enrichment is as permanent in its effect as is oxy-oil gas, which, from a very large number of tests, has been found to be practically perfect in this respect. As a matter of fact, the author has not found simple oil-gas enrichment to be permanent, as the following results will show, which are photometrical readings of the oil gas made, from the 74 cwt. of oil used, in the experiments already referred to:—

Statement of the Loss of Illuminating Power during Distribution of Coal Gas which had been Enriched with Simple Oil Gas.

	Candles.		Loss on Candle Power.		Loss in Distribution at 1½ Miles.
Illuminating power of gas put into gasholder	17·83	..	—	..	—
Illuminating power of gas tested out of gasholders; the bulk chiefly passing direct into and again out, without standing	17·77	..	0·06	..	—
Illuminating powers of gas tested no the district	17·26	..	—	..	0·57

The loss of illuminating power in the distribution of the oil-enriched gas should therefore be deducted from the enriching effect of the gas put into the holder, and the comparison made on the adjusted basis. The following statement will therefore show the comparison previously given corrected for loss of illuminating power during distribution, and will form a fitting summary to the conclusion of this paper:—

Cost of oil and oxygen per candle of enrichment during December, January, February, and March, oxy-oil process, gas distributed 1½ miles	0·37d.
Cost of oil per candle of enrichment, but without oxygen, gas distributed 1½ miles	0·73d.
Difference in favour of the oxygenated oil gas as against simple oil-gas enrichment, 49 per cent.	

Discussion on the Papers by Messrs, Bell, Glover and Herring.

Professor Lewes said the papers to which the members had just listened were among the most interesting that had been brought before the Institution for a long time. The first paper—that of Mr. Bell—called for but very few remarks. He was not quite sure as to the accuracy of the statistics furnished with regard to the cases of carbon monoxide poisoning, because, to make them complete, Mr. Bell should also have given the quantity of gas of each kind that was supplied. As they stood, they made the mixture of gas and water gas far more fatal than water gas by itself; and this must be erroneous. There was also a statement of the total percentage of carburetted water gas necessary to enrich coal gas up to 17-candle power; but he thought they would find that 30 per cent. was an over-statement, and that 10 per cent. would be much nearer the mark, judging by the practical working in London during the past three years. In London coal gas enriched by carburetted water gas, the total percentage of carbon monoxide was only 7½ to 8. Again, in mentioning tar experiments, some figures were given from the working of the Young process; but it would be well if everybody bore in mind, in speaking about gasifying tar, that this was not a uniform substance. It was all very well to take tar made from Scotch shale or cannel, and to find that one could get from this a certain amount of illuminating gas; but any gentleman who would try London coal tar would find that a considerable modification would be required in the figures. The benzene results which Mr. Bell gave were very valuable; and he mentioned that he knew of no process in which benzene was used for enrichment. But many had been devised ten years ago; and there was one in London, in operation at the Blackfriars and Cannon Street Stations, for enriching the coal gas there used by the Metropolitan Railway Company, in which the light hydrocarbons obtained as a liquid during the compression of oil gas in the Pintsch process, were employed to enrich coal gas; and this liquid consisted mainly of benzene and toluene. Mr. Glover's paper was an extremely useful working account of the Young process, for which they were most grateful to him. As a straightforward statement of facts, it was of great value. This brought him to the third paper—that by Mr. Herring on the development of the oxy-oil gas process at Huddersfield. He (Professor Lewes) had been twitted by some of the younger members, who seemed to consider that he had a special mission to oppose this process; but they should dismiss such an idea from their minds. Nothing would please him better than to see the process a success. The only objection he had to it was that he had made a large number of experiments upon it for something like seven months; and he was perfectly unable to find that the admixture of oxygen gave any great advantage over oil gas alone for enrichment. He had tried it in every way—mixing it hot, and mixing it cold; and he found that, as far as the oil gas alone went, a large increase of illuminating power was obtained by the addition of oxygen, simply because there was no burner which would burn oil gas to the full advantage by itself without some help of the kind. But when he used it for enriching purposes, and mixed it with poor coal gas, there was no further effect than if oil gas were used alone. Mr. Herring had taken an enormous amount of trouble over his paper; and it seemed ungracious to criticize it. At the same time there were one or two points of interest which ought to be noticed. In the first place, taking Mr. Herring's figures, he (Professor Lewes) found that he added 1·31 per

cent. of the oxy-oil gas to the coal gas; and if they calculated how much oxygen this meant, they would be struck with the amount present. The oxy-oil gas contained 15 per cent. of oxygen; and 15 per cent. of 1·31 worked out to 0·196, or rather less than 0·2, per cent. Now, turning to the paper, it would be found that the oxy-oil gas was placed into the bulk of the coal gas at the condenser inlet, and consequently it passed through the whole of the purifying plant, into which a percentage of oxygen, either pure or as air, was admitted; so that there was other oxygen and air present. If they put in the oxy-oil gas by itself, with its 0·196 per cent. of oxygen, surely Mr. Herring must be laughing in his sleeve when he asked any gas manager to believe that this would get through the purifiers. If he put in with it enough oxygen to entirely satiate the appetite of the purifiers for oxygen, it would be all very well; but how did he manage to so carefully apportion that quantity? In stuffing up a pastrycook's boy with stale pastry before sending him out on his rounds, so as to prevent him from stealing the fresh tarts, they must know exactly the boy's appetite; and he could not see how Mr. Herring arrived at the capacity for oxygen of his purifiers, nor did he give any analysis to show that any oxygen was to be found with the gas in the holder. Mr. Herring distinctly stated that, during the period for which the figures were given, the oxy-oil gas was passed through the purifiers. Leaving this point, he came to the part of the paper in which the cost of the process was given. Now, in the tabular statement the cost of carbonizing 66 tons of oil was given at £418 14s. 6d. Working this out, they arrived at the cost (roughly) of £6 per ton, including the cost of oxygen. Now, going back to Mr. Glover's paper, he gave £3 18s., as his total cost; but he allowed for the coke. Striking off this item, it would make the carbonizing by the Young process £4 a ton, which was one-third less than £6. What was the advantage to be obtained for this one-third of increased cost? That was the point to be considered. First of all, was it the increase in volume that made the gain? Referring again to Mr. Herring's paper, certain details were given as to the volume of gas produced. Mr. Herring said he was astonished at the enormous difference made in the volume of oil gas when oxygen was used; and he felt that there was no scientific reason to be given for it. The statement was that the average production per ton of oil during the four winter months, with 15 per cent. of oxygen, was 27,433 cubic feet of 70-candle gas. Now, 15 per cent. of this, or 4114 cubic feet, was oxygen; and deducting that left 23,319 cubic feet.

Mr. Herring remarked that the oxygen was luminous as well.

Professor Lewes said he quite understood that; but he was now referring to the volume of gas to be obtained from a ton of oil. Turning once more to Mr. Glover's paper, there were given off by the Young process of carbonization 22,000 cubic feet of gas; and going back to Mr. Bell's paper, they would find that, by the Pintsch and other processes of like character, 26,000 cubic feet was the ordinary yield. Now 70 candles was given as the power of the oxy-oil gas, and 53 candles as that of the 26,000 cubic feet of gas produced by the Pintsch process. They would, therefore, get, roughly speaking, an increase of this amount of illuminating power by the use of oxygen as against burning oil gas by itself; so that the two figures were not so wide apart. They had 27,000 or 26,000 cubic feet; but certainly there was not such a difference as would make it worth the one-third of extra cost. There was still another question to be answered. If the gain was not in the increased quantity, there might be an advantage in the enrichment value. Taking this as given by Mr. Herring, he brought it out as 0·52d. per candle of enrichment. Taking Mr. Glover's paper, it worked out at much less than a halfpenny, because there was still a large margin left in his calculation. This gave the plain oil gas a very considerable advantage. Mr. Herring then went on to explain that the superiority of the oxy-oil gas over the oil gas alone was its marvellous permanency, and the way in which it would travel. He proved this by making oil gas in the same retort as he used for the oxy-oil gas, and testing its carrying properties. He produced the oil gas, and found that, instead of getting 22,000 or 26,000 cubic feet, he had only 16,000 cubic feet. He stored this in the holder with coal gas, sent it out, and then ascertained the lighting value 1½ miles away. He (Mr. Herring) was astonished to find a considerable loss in the illuminating power; and he did not know how to explain this loss except by the fact that the oil gas would not carry. The diminution in volume was the answer to the whole experiment. The oil gas was made at a temperature at which it was chiefly vapour; and under these conditions this vapour would deposit. It could not possibly travel and give the extra result. Again, a second experiment, of much greater value, was made, in which he treated the oil at a higher temperature, so as to get 20,000 cubic feet; and he found that, under these circumstances, the loss in gas enriched by this oil gas over the 1½ miles was 0·57 candle. But would Mr. Herring guarantee that his original coal gas would not lose 0·57 candle over the same distance?

Mr. Herring said no; his argument was that the oxygen rendered the gas permanent in transit.

Professor Lewes said they had to thank Mr. Herring for the great trouble he had taken; and he must apologize to him for making himself disagreeable. He could assure Mr. Herring that he wished every success to him and the process; and he hoped, when it was in thorough working order, he would allow him to come down and see it.

Dr. Thorne said he would not detain the meeting with any extended remarks, although there were many points he should have liked to mention. As his experiments had also been made with oxy-oil gas, he would confine himself almost exclusively to that. Since these experiments and those of Professor Lewes were so contradictory, he should have to confine himself very largely to the discussion of what that gentleman had said. In the figures Professor Lewes had put upon the blackboard, he had given £6 as the cost of a ton of oil made into gas for enriching purposes by the oxy-oil gas process, and £4 per ton under the Peebles process. He had then taken the yield of oxy-oil gas, and had tried to show that, taking off 15 per cent., one did not get much more enrichment by the oxy-oil gas than by the Peebles process. But he thought he had been rather unfair in his treatment of the process in this way, because, on the one hand, he had taken off the 15 per cent. when dealing with the bulk, but did not make any corresponding deduction or take into account the different enriching values of the produced gases. If the results were taken in a slightly different form, they wore a different aspect. His experiments, carried on both on a small and on a large scale, at the Huddersfield Gas-Works, some time before those of Mr. Herring, and perfectly independently of him, agreed very closely with that gentleman's. He had worked out the enrichment value of the gas as given by Mr. Herring, showing that it came out about 116 candles per 1000 cubic feet. The average of his figures, which he intentionally took rather lower than he might have done, was 107 candles; thus confirming Mr. Herring's figures. Mr. Glover's figure was 96·5 candles. If they took the enrichment figures given in the two papers, and multiplied them by the quantity per ton of oil—(27,433 ÷ 5) × 116—it would be found that the ton of oil treated by the oxy-oil gas process gave 636,445 candles as the value for enriching purposes; whereas taking 22,000 cubic feet of oil gas per ton made by the Peebles process, and Mr. Glover's figure of 96½ candles, and calculating these out, the result was 424,600 candles. This showed a proportion closely corresponding to the figures put on the board as to the price. There was one point in Mr. Glover's paper where he put the value of the coke at £1 per ton, which seemed to him (Dr. Thorne) rather a high price.

Mr. Paddon said the only subject he proposed to deal with was that of carburetted water gas. This was only touched upon by Mr. Bell, who began with a reference to the effect of carbon monoxide. He (Mr. Paddon) rather thought they had heard the last of this; but it was an old friend which came up for treatment again and again. They were given a very terrible list of casualties, amounting to 250, of which only 8 occurred from the effects of coal gas by itself. But this was to some extent qualified by the fact that two-thirds of all the illuminating gas made on the American Continent was carburetted water gas; and the only places in which simple coal gas was made were unimportant villages and very small works. These figures would, no doubt, be greatly improved upon in another year or two, when the advocates of exclusive coal gas would be able to draw attention to the fact that nobody died of it, simply because by that

time, in all probability, its production in America would have come to an end. There were in America 350 works making carburetted water gas; so that the list of casualties did not allow of one apiece. This at least would go to show that in certain places the gas was made without mishap. Of these cases, 37 were those of authenticated suicide, for which he hardly supposed the gas supply would be held responsible. The point was not worthy of serious consideration; for life and property were looked after quite as closely in America as they were in England. On the next point, the heating efficiency of the apparatus was impugned; and it was represented that the calorific value of one-half of the material used was lost. This matter had received very deep and exhaustive consideration in a paper which was read some three years ago, in which it was clearly shown that, of the fuel used in the generator, more than 60 per cent. of its efficiency was realized; and of the oil and fuel together, more than 80 per cent. This possibly still left something to be desired; but it was something he did not think they would get in any such form of heat apparatus. He was responsible in part for the next set of figures, which were originally presented three years ago, giving them 2s. 1d. as the cost per 1000 cubic feet of 25-candle gas. In the succeeding year, this figure was very considerably reduced; but, notwithstanding this, it still came up here again as 2s. 1d. If there had been time to read the paper which he had prepared,* it would have been seen that it had been reduced to 1s. 4½d. by a plant working on the scale of 8 million cubic feet per day. The cost per pound of sperm produced was 0·193d.; while the cost per pound of sperm of 16·5-candle gas in the Metropolis, taking the years 1890, 1891, and 1892, was 0·305d., which was rather in favour of carburetted water gas. The next point raised referred to America; and it was based ostensibly on a report of the Massachusetts Gas and Electric Light Commissioners. He could not follow it. It was said to be an official report; but he was disposed to regard it as a pre-historic one. The report he had, dated January 1893, gave statistics in relation to the production of carburetted water gas in Massachusetts. The Bay State Company, which made three-fourths of the total quantity of this gas, or three times as much as all the other contemporary works in the State produced, appeared to use 45 lbs. of fuel and 4¾ gallons of oil per 1000 cubic feet. Their accounts were fully published; and the cost of gas at the *burner* to the Company producing it was 36 c., or 1s. 6d., per 1000 cubic feet. There was some disparity between this and the figures quoted. Mr. Bell said that to enrich coal gas from 14 to 17 candles by 25-candle power water gas would require 30 per cent. of the latter; and he assumed the cost of 14-candle power unenriched gas at 1s. per 1000 cubic feet. Now he had taken all the 14 to 15 candle gas he could find reported upon in Field's "Analysis" for the last three years; and he found the average worked out at 1s. 6¼d. per 1000. In one instance —at Portsea—it was made at 1s. 0¾d.; but this was the cheapest. In other places, it cost as much as 2s. This, of course, affected the comparison made. Then the price given for the production of carburetted water gas was 2s. 1d.; but, as the actual figure was 1s. 4½d., the comparison should certainly be based on this, and not on the incorrect figure.

Mr. Herring, in reply, observed that Professor Lewes preferred to take the results of his experiments, which he said had lasted over a few monts; but he (Mr. Herring) naturally preferred to take his eight months' continuous working of the process. He expected that his remarks with regard to the advantages of oxygen would probably produce the same effect upon Professor Lewes that the stale pastry had upon his errand boy. It was upon this point that the whole thing hinged. All he could say was that they had worked it; and, as far as he knew, they had worked it honestly, and had endeavoured to get at accurate results, which were contained in the paper. Why they obtained them, he did not profess to explain. There they were; and he thought they were worth further investigation by others, who perhaps had more time to devote to the matter than he had. Professor Lewes had taken up the question of the cost per ton of oil for labour as given in the paper; but he had omitted to take into account the qualifying paragraph immediately preceding. At the time given, they were working only one bay; while it would be easy work for one man to attend to two bays. The labour, therefore, was not very costly. At St. Helens it was stated to be 3s. per ton of oil; but it was not shown how it was divided over the 24 hours, or whether they worked eight-hour shifts, for which he (Mr. Herring) paid 4s. This item of labour could, no doubt, be reduced, and likewise the cost of the oxygen. Professor Lewes then turned to the slate, as was his custom, and proceeded to show that there was nothing worth considering in the results given. He commenced by deducting the 15 per cent. of oxygen from the bulk of the gas obtained—27,433 cubic feet per ton, of 70 (actual) candle power—and only credited them with the remainder. This he thought was hardly fair, as it was all illuminating gas. With regard to the permanency of the first batch of oil gas, he thought he had made it plain that this was unsatisfactory, and that he did not believe in it himself. He started it on exactly the same lines as he worked the oxy-oil process; but he had put it aside as unreliable, as the yield of gas per ton of oil led him to conclude that the heats were insufficient to make a permanent gas. He simply gave it for what it was worth. But he based his statement on the last experiment of 74 cwt. of oil; and since writing the paper, he had had the plant running for a week with oil only, and the results were practically the same. They did, however, certainly get more residual oil flowing back when they were not using oxygen; the heats and other conditions being the same as when they were employing it. This was a matter for scientific men to settle. At Huddersfield, meanwhile, they were receiving the benefit of the process; and they should continue to use it. Taking a few figures in comparison with the Peebles process, he found that the enriching effect of the Peebles gas was stated to be 3·189 candles for 4·8 per cent. added. The oxy-oil gas was 1·29 candles for 1·31 per cent., or 0·81 of a candle per cent. of Peebles gas against 0·98 of a candle per cent. of oxy-oil gas. This showed a gain of 20 per cent. in favour of oxy-oil gas. The quantity and cost of enriching gas required to enrich 1000 cubic feet of coal gas one candle by either process was 12·27 cubic feet, at a cost of 0·45d., for Peebles oil gas, as against 10·16 cubic feet, at a cost of 0·38d., for oxy-oil gas; showing a gain of 18·4 per cent. in cost in favour of using oxygen in connection with the manufacture of oil gas.

Mr. Glover said he did not profess to be a wizard, and to explain things which "could not be explained on scientific grounds." He would rather they had been made clear by those who had already had opportunity; and he thought certain things which had been spoken of as inexplicable could be explained. It was quite evident to him, having had some experience in making permanent oil gas, that the apparatus at Huddersfield, although supposed to crack oil into gas and coke, did not do so. Whatever oxygen did in helping pure oil gas to burn, he conceived that the only thing it did, when mixed with oxy-oil gas outside of the retort, was to act as a carrier. It was quite evident, from the results obtained from the Huddersfield plant when working oil alone, and making oil gas pure and simple, that very little permanent oil gas was produced, and a great quantity of oil vapour was sent forward. This was proved again by the results obtained from the second experiment, when gas was made alone, and passed through the gasholder to the district. The results obtained from this apparatus were such as would knock oil gas out of existence; and if he had not been able to get anything better from the Peebles process than could be obtained from one that acted in this way, he should be very sorry that he ever introduced it. At the present time, he was getting such excellent results, and with so much ease and comfort to himself and the men, that he was very glad indeed he had adopted the process; and he thought he had proved results up to the hilt. He passed a little coal gas (only about 1 per cent.) into the hydraulic main of the oil-gas works, to perform such services as were obtained by this complicated process of mixing oxygen and badly-made oil gas produced by the oxy-oil process. With regard to the question Dr. Thorne had asked about the coke, he had brought some samples which were on the table. It was a most valuable form of fuel, with only 33 per cent. of ash in it; and it was well worth £1 a ton. The system as worked at St. Helens had been carefully examined by many well-known gas engineers;

* This paper will be given in a subsequent issue.—Ed. J. G. L.

and all had spoken highly of it. The figures he had given were the result of practical experience; and he was only sorry there was not time for a fuller discussion.

Mr. BELL said the only point to which he had to reply was that raised by Mr. Paddon with regard to water gas. He did not wish to do water gas an injustice; but the figures he put in his paper were taken from the Transactions of the Institution. They were 2s. 1d. per 1000 cubic feet for 25-candle gas; and the Massachusetts Commission (which he presumed was an independent body) gave the average at about 2s. 2d. Seeing that they had in America large quantities of oil, mostly cheaper than it was here, and also a considerable quantity of fuel specially suitable for producing it, they ought to be able to make it as cheap as in England. Mr. Paddon seemed rather annoyed that he (Mr. Bell) should have brought forward the number of deaths due to poisoning by water gas. But they were given in an official report; and there was no reason why the facts should not be faced. There was no doubt that carbon monoxide was a very poisonous gas; though if only 10 per cent. of water gas of high quality were used, of course the percentage would be small. Still he found that in the United States in 1891 there were 139 accidental deaths from this gas; in 1892, 178 deaths; and in 1893, 215 deaths. Consequently, as the use of water gas had extended, so the number of deaths kept increasing. With regard to percentages, Professor Lewes had said they only used 10 per cent.; but he did not mention what the quality of gas was, or what enrichment was effected, and it all depended upon this. He was glad to hear that the cost of water gas had been reduced, according to Mr. Paddon's paper (which he was very sorry had not been read), to 1s. 4d. per 1000 cubic feet; and he should be very pleased if it could be reduced still lower. He had no objection whatever to water gas; but they ought to face the subject fairly. The main purport of his (Mr. Bell's) paper had reference to carburetting with benzol, which he believed was largely used in Germany; and the cost there was about ½d. per candle.

The PRESIDENT said he had to apologize, on behalf of the Council, for the short time available for the discussion of these valuable papers, which he was sure would be much appreciated by all the members.

The Sanitary Institute.—The preliminary programme of the Fourteenth Congress, to be held in Liverpool in September, has been issued. The business at the congress will consist of three general addresses and lectures, three sectional meetings, and five special conferences. In connection with the congress, there will be an exhibition of sanitary apparatus and appliances and articles of domestic use and economy; and excursions will be organized to places of special interest. The local arrangements are in the hands of an influential Committee, presided over by the Lord Mayor of Liverpool, with the City Engineer (Mr. H. Percy Boulnois, M.Inst.C.E.) and the Medical Officer of Health (Dr. E. W. Hope) as Honorary Secretaries.

A Water-Level Indicator for use in driving wells, which is attracting, according to the *Engineering Record*, some attention among German hydraulic engineers, consists of an apparatus attached to a graduated steel tape, and provided with an electric bell, which rings when it reaches the water; the purpose of the device being to notify the person making the soundings as soon as the water is touched, so that he may read off the depth on the tape. The apparatus consists of a metal tube containing a dry battery, a float which closes the electric circuit as soon as the water is reached, and a bell which is rung by the electric current when the circuit is closed. The device can be made to work in a 1½-inch well; and it is said to have proved valuable in experiments at several German water-works.

Federated Institution of Mining Engineers.—The members of this Institution will hold a general meeting at the Institution of Civil Engineers on Thursday and Friday, under the presidency of Mr. A. Sopwith. We learn, from the programme which has been issued by the Secretary (Mr. Walton Brown), that the proceedings will include papers on the following subjects: "Petroleum and Oil Shales in Britain," by Messrs. Boverton Redwood and Topley; "The Probable Range of the Coal Measures in Southern England," by Professor Boyd-Dawkins; "The Rating of Mines," by Mr. E. J. Castle; and "The Proportion of Carbon Dioxide (Choke-Damp) in Air which is Extinctive to Flame," by Professor F. Clowes. The following papers, which have appeared in the Transactions, will be open for discussion: "The Oil Shale Industry of France," by Mr. G. Chesneau; "Spontaneous Combustion in Coal Mines," by Mr. W. S. Gresley; and "The Transmission of Power by Compressed Air" by Professor Goodman. Arrangements have been made for a visit to the works of Messrs. Siemens Bros. and Co., Limited, at Charlton, on the second day of the meeting.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1084.)

THE general position of things in the Stock Markets is very much the same as it was a week ago. Most departments remain quiet and sedate, uneventful, and unchanged; they might almost be said to be in a state of suspended animation. There are, of course, exceptions to this rule to be met with among the miscellaneous descriptions; but the principal departure from it is to be found in the gilt-edged securities, where the demand never ceases. Money, which is a drug in the market, must be disposed of somehow; and Consols, even at 101⅜ *ex div.*, are better than nothing at all. Municipal stocks and the best railway debenture and preference stocks are also proportionately pushed up. As for the Money Market, the over-abundance of gold is quite unprecedented; and week after week the "record" for the Bank of England's stock is broken. Business in the Gas Market has not been very brisk; but the general tendency continues to be firm, and all good stocks command good prices. The chief incident of the week is the notification by The Gaslight and Coke Company of a reduction in their price, which, though the phraseology is somewhat ambiguous, would appear to be not retrospective as in the case of the South Metropolitan Company. The market regarded this step with favour; and the "A" stock, which opened at 227, rose to 232½ at the close. The reduction in price, if prospective, cannot affect the rate of dividend until next February; and, indeed, it is to be hoped, in the true interests of the undertaking, that there will not then be any augmentation of the rate, even if the financial position should allow it. Very fair business was done in the secured issues; but the only move was an advance in "H." South Metropolitans were more active, and well maintained their recent rise, though they did not improve upon it. Commercials also showed more animation; and the old stock gained a point. Hardly anything in the Suburban and Provincial division was touched. Continentals were quiet and unchanged, except Union, which was active, and whose preference rose 2. Other changes were slight, and were almost confined to the South American undertakings. Water was quiet, and for the most part unchanged; a recovery in Lambeth being the only feature.

The daily operations were: Business in Gas was quiet on the opening day; and quotations were unchanged, beyond a fall of ¼ in Pará. Tuesday was more lively; and prices in general were better. Gaslight "A" rose 1½; and Commercial old, 1. In Water, Lambeth 10 per cents. rose 2; and the 7½ per cents., 1. Wednesday was equally buoyant; and good figures were realized for all the leading stocks. Monte Video rose ½; but Buenos Ayres debentures fell 1. Thursday was a quieter day; but the general advance proceeded, with a rise of 2 in Continental Union preference, and 1 in Gaslight "A." Activity was resumed on Friday; and Gaslight "A" rose ½ more, and ditto "H" improved 2. Saturday's transactions were almost wholly confined to Gaslight "A," which advanced 2 more; making a total rise of 5 in the week.

ELECTRIC LIGHTING MEMORANDA.

The Lighting of St. Paul's; an Opportunity for the Mayor of Wolverhampton—The Affairs of the London Electricity Supply Companies—The Capital Value of the Electric Lighting Industries of the United States.

SOME interest has been excited by the announcement in several London newspapers of the intelligence that the experiments which have been going on for some time past, with the object of lighting St. Paul's Cathedral by means of electricity, have been abandoned in consequence of the apparent hopelessness of the attempt to make electric lighting an acceptable substitute for gas. It has been stated that notwithstanding the use by the electricians engaged in these interesting experiments of the "most improved" apparatus, the effect of lighting the dome by means of arc lamps was simply ghastly. The shadows produced were so black and sharp as to be destructive of the proper appearance of the architectural features of this grand and unique interior; and, in short, nothing that could be done with or to the lamps was of any avail in curing them of their inherent vice of being much too bright where their light was not wanted, and leaving utter darkness where a restful *chiar' oscuro* was desired. The failure was taken to heart by the electricians concerned, who hastened to assure the public that they did not intend to give up the job, but had merely retired from the task for the summer, in order to make ready for a successful attack upon its difficulties next autumn. This is as may be. The fact remains that in a conspicuous example a system of lighting that has had arrogated for it the distinctive titles of scientific and improved has been found wanting in the qualities needed for giving a pleasing effect in use. Doubtless St. Paul's might be lighted by incandescent lamps so disposed in lines as to bring out the salient features of the architecture,

just as was done at the South Kensington Exhibitions; but the expense of this method of lighting is manifestly beyond the reach of the Cathedral authorities. In connection with this subject, it may be mentioned that we have just received from the Mayor of Wolverhampton (Alderman C. T. Mander, J.P.) a report to the Lighting Committee of the Council, "showing the advantages of electricity as an illuminant, compared with those of gas." We find in this production the statement that "electricity at 6d. per unit, if used for the same number of hours as gas, *light for light*, cannot exceed the cost of gas at 2s. 9d., by more than 34 per cent.; if used with care, by more than 20 per cent.; if used with extra care, by more than 5 per cent. In fact, it is very questionable whether electricity at 6d. per unit, is not cheaper than gas at 2s. 9d., if used with an ordinary burner." Now, there is evidently a great commercial future for Mr. Alderman Mander, if he will only back these estimates by his own money. Why not come to London and start by taking on the lighting of St. Paul's by incandescent electric lamps at the same price as gas? It would be a splendid advertisement, and would prove Mr. Mander's case better than all the pamphlets in the world. His Worship of Wolverhampton is evidently just the man wanted by London central station lighting companies to brighten up their shady fortunes.

Our contemporary the *Electrician* published in its issue for the 25th ult. its annual analysis of the capital and revenue accounts of the statutory electricity supply Companies at present at work in the Metropolis. In this it does for the subjects of its attention the service we have been long accustomed to render to the London Gas Companies; and, like us, it has found that, while the Companies in question are fain to lay their accounts open to the statisticians' examination, the various managements are greatly averse to the drawing of any morals therefrom which are uncomplimentary to themselves. "Every company's system is, of course, the best; refrain from hinting otherwise!" From which it appears that poor human nature, which makes gas-works administrators so very touchy in regard to their results when these are not patently the best of their kind, has not been wholly eliminated from the improved and intensely scientific industry of electric lighting. The summarized accounts show that up to the close of last year the ten Companies and one Vestry engaged in the electricity supply business in London had spent between them close upon 3½ millions sterling. It is difficult to generalize from our contemporary's statistics, inasmuch as no fewer than 26 notes are needed to qualify and explain the entries in the tables of capital and working expenditure. It comes out from the former, however, that the average capital expenditure per lamp connected now stands at £5; but the best individual figure for this is £2 10s. in the case of the Chelsea Company. The direct-current Companies run to as much as 44 per cent. of capital spent upon mains; while the largest alternating-current Companies get off with about 20 per cent. on this score. The total income of the Companies for the year was something over £250,000 from current sold—a very respectable revenue to be derived from the sale of something which ten years ago nobody knew he wanted. The working expenses of the Companies ranged from 44·6 to 99·3 per cent. of the receipts; and the average rental per 8-candle lamp works out to 7s. 6d. for the year.

Judging from a statement made by Professor E. A. Armstrong in the course of his address as President of the National Electric Light Association of America, there are now in the United States, "according to the most trustworthy information available," upwards of 2300 electric supply undertakings, "representing an invested capital of £40,000,000;" and it was also estimated that at least an equal sum is similarly represented in the industries of electrical machinery and supplies manufacture. These be big figures indeed—being enough to satisfy even the proverbial American taste for bigness. But there appears to be something missing from Professor Armstrong's estimate. He speaks only of amounts of capital "represented;" and it is astonishing how well statisticians can represent gold by "water" when they desire to make a gaudy picture. It is tolerably notorious that much of the nominal capitalized value of the United States electric lighting industry is nothing but "water," standing in the name of solid stocks. It would be difficult to give the exact proportions of the ingredients of which this class of "investments" is compounded; but it would be pretty safe to hazard the guess that, if an enterprising capitalist were to offer 10 millions sterling in gold for all the electric lighting stock extant in the States, he would be buried under the mountain of scrip that would pour in upon him from the crowd of holders who would prefer to realize for the purpose of going into another sort of business.

Withdrawal of the Great American Electric Traction Prize.—A short time ago, an offer was made by the Metropolitan Traction Company, of New York, of a prize of $50,000 to the inventor of the most perfect system of street electric traction. After receiving between 3000 and 4000 schemes, the Company withdrew their offer; stating that the State Railway Commissioners had declined to act as judges, as was originally intended. The *Electrical World* makes some strong comments upon the action of the Company, and considers that the time and the money of several thousand inventors have been wasted over a sham competition.

COMMUNICATED ARTICLE.

THE DEVELOPMENT OF THE GASHOLDER.

By Alex. M'I. Cleland.

IV.

In the year 1810, gasholders of about 1000 cubic feet capacity were considered amply sufficient. Twelve years later, the then Government Inspector, Sir William Congreve, reported that one works contained several gasholders each of the *enormous size* of 40,000 cubic feet. About this time, Sir Humphry Davy gave utterance to his historic sneer, and suggested that Clegg would be taking the dome of St. Paul's for a gasometer. But by 1855, the latter, as his son records, was able to see a gasholder erected many times larger than the aforesaid dome. Later, Mr. Charles Hunt was remonstrated with for building a holder capable of containing 2 million cubic feet of gas; and doubtless Mr. Corbet Woodall underwent the same experience about 1878, when erecting his 3 million cubic feet holder. Nay, Mr. Woodall himself mildly protested against Mr. Livesey's 5½ million holder; and during the discussion of the latter's paper, "The Principles of Gasholder Construction,"* delivered in 1882, remarked that to erect anything larger would be "an insult to the neighbourhood" on æsthetic grounds. With regard to the latter objection, it is to be feared that a neighbourhood which demands 8 to 10 million cubic feet of gas per diem is utterly past redemption, æsthetically considered; and so its artistic propensities cannot be much injured by a couple or more of large gasholders.

Although the "neighbourhood" seemed to take the 5½ million holder very quietly, the gas world was nevertheless considerably startled when, on March 3, 1891, an advertisement appeared in the JOURNAL OF GAS LIGHTING, asking for tenders for the erection of a gasholder to contain 12 million cubic feet. But by the time it was actually erected, opinion was so far reconciled to the new departure which this—for the time being, at least—gigantic holder marked, that the President of the Incorporated Institution of Gas Engineers was able to remark that expectations might not unreasonably be entertained that the gas world would shortly see holders designed and built for a total capacity of 20 or 24 million cubic feet.

The comparative difference in size between a 6 million holder and a 12 million holder is about the same as that between a tea cup and a breakfast cup, though, looked at in the abstract, the difference appears stupendous, notwithstanding the dimensions over all may not vary more than 60 or 70 feet. For instance, the holder designed by Mr. George Livesey in 1881 for the Old Kent Road works has a diameter of 215 feet and a height of 120 feet; that designed ten years later by Mr. Frank Livesey for East Greenwich, a diameter of 300 feet and a height of 180 feet, though the guide-framing of each holder is of the same height. But what specially distinguishes the East Greenwich holder is not merely its total cubical contents, or its extremely low capital cost per 1000 feet of storeage, but the fact that its design marks a most distinct advance and innovation in gasholder construction, and one which, like most important departures from usual and old-established lines of procedure, had been foreshadowed for years prior to 1891.

The holder at East Greenwich has six lifts, of a total height of 180 feet; but the framing extends to the height of four lifts only—the remainder rising free above the tops of the standards. When collecting notes for the present article, the writer was much interested to find that a suggestion to reduce the height of the guide-framing below the total height of the holder was first made by Horton† as far back as the year 1851. Horton, either alone or else in conjunction with his colleague Palmer, appears to have given a considerable amount of attention to the construction of gasholders about this time; and he introduced improvements in the construction of the cups, crown curbs, roof, and framing. In the specification in which he deals with the framing in connection with his proposal to reduce its total height, he says: "By means of my improvement, a very considerable economy in the construction of the guide-framing for telescopic holders is effected, inasmuch as the columns and girders I employ do not require to be more than about half the height of those usually employed." He claims, "First, the use and application of vertical travelling-standards fixed to the lower or outer holder," &c.

Briefly, his suggestions were as follows: Around the curb of the tank, a framing was to be erected, composed of the usual type of cast-iron columns and girders, which was to extend to the height of the outer lift only. On the grip of that lift a second, and lighter, framing was to be erected, which was to be but half the height of the first one. As the inner lift, after "cupping," continued to rise, the inner framing and outer lift rose with it, both being guided by the outer framing, till the holder was full, when half the inner holder would rise freely above the inner framing, and the latter would also rise for half of its height above the outer framing. The above proposal was made more than three decades before its time; and it is extremely doubtful if it was ever seriously entertained, though eight years later a double-lift holder, belonging to one of the Metropolitan Gas Companies, was altered to a treble-lift on

* See JOURNAL, Vol. XXXIX., p. 1189; also Trans. Gas Inst., 1882.

† Patent No. 13,436.

the lines laid down by Horton. The experiment was, however, a failure—the holder never working satisfactorily; and it was reconverted to a double-lift about the year 1863.

Nothing more was heard of the possibility of reducing the guide-framing below the total height of the holder till December, 1881, when Mr. George Livesey addressed to the JOURNAL OF GAS LIGHTING his historic letter, in which he said: "I believe it would be quite practicable and perfectly safe to erect and work such a gasholder as this [the 5½ million holder at the Old Kent Road works] with three lifts of 53 feet each, if the guide-framing reached only high enough for one lift—say 55 feet—in order to guide the inner holder until the second is cupped." In another portion of the same letter, Mr. Livesey said he believed the above idea would some day be carried out in practice. How thoroughly he has proved his confidence in his own belief is too well known to need mention.

At that time, the only result of Mr. Livesey's suggestion appeared to be the proposed design for a self-sealing and self-supporting gasholder which was next year (1882) brought before the notice of the North of England Gas Managers' Association by Mr. V. Wyatt; and although his ideas were not taken up, the suggested reduction of the guide-framing was not forgotten, though the subject once more dropped out of sight for a further period of five years. The idea, however, was fructifying, and was being seriously considered by some of the most eminent engineers of the day. When, therefore, an article appeared in the JOURNAL OF GAS LIGHTING on March 29, 1887, entitled, "Is Lofty Guide-Framing Necessary for Large Gasholders?" it was quite to be expected that the ideas put forward by the writer—Mr. W. H. Y. Webber—should be received with all due gravity. For the next twelve months the subject was very much in evidence in the gas world. It was brought before The Gas Institute by Mr. Webber at the meeting in 1887, and by the President of the meeting of 1888 (Mr. C. Gandon), and was thoroughly discussed in the technical journals; opinions merely differing as to whether the reduction of the guide-framing should be partial or entire.

Up to June, 1888, the matter had been discussed almost entirely on theoretical grounds; but by July of that year the problem of the partial reduction of the guide-framing had been solved by Mr. Livesey, with the greatest success and satisfaction, at the Rotherhithe works of the South Metropolitan Gas Company. Finding it necessary to convert a holder at these works from a double-lift into a treble-lift, Mr. Livesey decided to add the third lift without increasing the height of the guide-framing. The holder selected was about the worst of its kind that could have been chosen for such an experiment, as it had been built for more than twenty years, and stood in a wrought-iron tank which rose about 12 feet above the ground-level. The tank itself was weak; and the holder (which was 150 feet in diameter, each lift being 25 feet in depth) had a very heavy trussed framing, a list of 5 inches, and a weak bottom curb. The guide-framing was of the old-fashioned columnar type, with two tiers of girders. Having strengthened the weak points of the structure, in as inexpensive a manner as possible, and added tangential rollers to the middle and outer lifts, the holder was raised to its full height on July 25, 1888; and it has worked satisfactorily ever since—thus marking the commencement of a distinct epoch in the construction of gasholders.

The practicability of a reduction in the height of the framing having been thus demonstrated, further development in this direction was expected as a matter of course. This was seen three years later in the 12 million holder erected at the East Greenwich works of the same Company, to the designs of Mr. Frank Livesey, by Messrs. Clayton, Son, and Co., of Leeds. The details of this famous holder are too well known to need more than the briefest reference here. The holder has six lifts, of an average diameter of 293 ft. 8 in. and an average depth of 31 ft. 5½ in., the shallowness of each lift being at once noticed as "the proportion of diameter to depth of side is a little over nine to one—about the proportion given by the diameter of a penny to twice its thickness." The two inner lifts, rising above the framing, are specially strengthened in order to enable them to withstand the severe strains to which they are necessarily subjected; the second lift having no fewer than 128 vertical stays, one half fixed outside, and the other half inside. The crown curb is of the simplest description. The outer crown plate and the upper side plate are of steel, 1 inch thick; and attached to these are plates of iron ½ inch thick. The outer angle ring is 6 in. by 6 in. by 1 in., and the inner angle ring 6 in. by 4 in. by 1 in., both of steel. The system adopted in the guiding of the holder has already been referred to in this article (*ante*, p. 839). As was to be expected, the guide-framing is of the "advanced cantilever" type, so long favoured by Mr. Livesey, the standards—32 in number and of H section—having a depth of only 2 ft. 6 in. at the base. "They have no horizontal attachment except at the top, where there is a strong girder 2 feet deep with a 22-inch top flange. . . . As there are no horizontal members to form struts, with the exception of the top girder, the diagonals are made T shape in section, formed of two flat bars connected with an angle-iron,"* the section varying according to the height at which they are placed.

(*To be continued.*)

* Trans. Inc. Inst. Gas Eng., 1892, "Six-Lift Gasholder and Tank at East Greenwich."

TECHNICAL RECORD.

THE INCORPORATED GAS INSTITUTE.

The Programme for the Forthcoming Annual Meeting.

As already announced in the JOURNAL, the annual meeting of The Gas Institute will take place at the Westminster Town Hall, on the 19th, 20th, and 21st inst., under the presidency of Mr. John West, M.Inst.C.E. The official programme has now been issued; and we are thus in a position to give an outline of the proceedings.

The chair will be taken at 11 a.m. on the first day; and after the preliminary business has been disposed of, the report of the Council, accompanied by the accounts, &c., will be presented. The Council open their report with an expression of gratification at the satisfactory position of the Institute. At the close of last year, the membership list stood as follows:—

Honorary members	19
Ordinary members	412
Extraordinary members	38
Associate members	31
Associates	53
Total	553

Last year 24 candidates were elected as members, six as associate members, and four as associates. Four transfers were also made to the class of members. The Council record with pleasure a continued growth in the applications for admission. They take this as unmistakable evidence of the high esteem in which the Institute is held by the profession—both as regards its continued usefulness as an educational medium, and as a means for the dissemination of technical knowledge, as well as the interchange of practical experience. Since the last meeting, eleven resignations have been received and accepted; and thirteen members were removed by death. They were: Mr. T. Hawksley, London; Mr. W. Duesbury, Cambridge: Mr. L. Hislop, Bothwell; Mr. J. Hutchinson, Barnsley; Mr. H. M. Layard Jones, Rome; Mr. W. J. Moon, Scarborough; Mr. W. Oldfield, Goole; Mr. C. E. Porrie, Slough; Mr. J. Reed, Newport (I.W.); Mr. G. Ridley, Newcastle-on-Tyne; Mr. W. Syms, Rochester; Mr. R. B. H. Thomson, Broughty Ferry; and Mr. H. F. Willey, Exeter. Two of these (Mr. T. Hawksley and Mr. J. Hutchinson) were among the oldest members and founders of the Institute. The Council express their thanks to those Gas Companies and Corporations who have subscribed to the funds of the Institute; thus enabling the Technical Committee to continue the work of research. They impress upon the members the desirability of increasing the number of these subscribers, with a view to add to the usefulness of the Institute in this and other directions, and especially to enable it to take up the parliamentary work of the late Gas Companies' Association. The Council next refer to the removal of the offices, which has resulted in considerable saving; and other economies have, they state, been introduced, the full effect of which will not be seen until the close of the present year. The general financial position of the Institute has engaged the attention of the Council; and they are pleased to record the fact that the finances are now satisfactory. Since the publication of the balance-sheet at the end of 1893, the greater part of the then outstanding accounts has been paid; and it is confidently expected that early in next year all liabilities will be extinguished. They point out that every care is taken to curtail expenditure; and with an increased membership roll, together with the general support of Gas Companies and Corporations, they will be in a position to open up a wider field of labour for the benefit of the profession generally. In accordance with the usual custom, a circular was recently issued to each member with regard to the award of the Birmingham Medal. After considering the various suggestions received in reply thereto, the Council decided to make the presentation to Mr. W. A. Valon, J.P., "for the valuable services he has rendered the gas industry by his important experiments and research." Reference has already been made to the Gas Companies' Association. We learn from the report that, since the closing of that Association, the Council have had under serious consideration the desirability of taking up some such work as an additional branch of the Institute. After full deliberation, they are of opinion that it would be undesirable to allow the whole of the valuable work hitherto performed by the Association to be abandoned; and while they see that the reasons which at first prompted the promotion of the Association no longer exist to the same extent as heretofore, still they think a re-establishment on new lines will prove beneficial to the Institute, its members, and the various Gas Companies throughout the kingdom. They have, therefore, decided to formulate a scheme to carry this into effect; and they have engaged the services of Mr. William Livesey, the late Secretary of the Association, to assist them in the matter. The Council tender their thanks to the various donors of books to the Library, a list of which is appended to the report. A design for an official certificate of membership has been adopted; and copies will be ready by the date of the meeting.

The presentation of the report and accounts, the Birmingham

Medal, and the premiums for papers will be followed by the President's Inaugural Address; and then an adjournment will be made for luncheon. The afternoon will be devoted to the reading and discussion of papers; and at the close of the sitting, the annual meeting of the donors and subscribers to the Benevolent Fund will take place.

The second day of the meeting will be given up entirely to business; but in the evening there will be a reception by the President in the St. Martin's Town Hall, to be followed by a *conversazione* and dance.

On the third day, the remaining papers will be disposed of, and the miscellaneous business transacted. Permission has been given by the Incandescent Gas-Light Company, Limited, whose works are in close proximity to the place of meeting, for an inspection thereof by members who may desire to witness the production of this now popular lighting medium.

The list of papers and communications is a long one—no less than thirteen being down for reading and discussion. It may be truly said that they deal with all the questions which are now engaging the attention of the managers of gas-works. First stands a paper by Mr. H. Ashton Hill, on "Gas Manufacture at Wallasey, with Special Reference to Enrichment by Cannel." Mr. J. Stelfox, of Belfast, will recount "A First Season's Experience of Carburetted Water Gas;" and Mr. C. Stafford Ellery, of Bath, will discourse on "The Application of Coal Tar for Making Gas." Mr. W. R. Chester, of Nottingham, will describe "The Construction and Working of Regenerative Settings of Retorts;" and Mr. T. S. Cleminshaw, of Launceston, Tasmania, will contribute some information on "Gaseous Fuel in the Retort-House." Mr. F. G. Dexter, of Winchester, will deal once more with the subject of "Steam Applied as an Aid to the Revivification of Oxide of Iron *in Situ*;" and Mr. J. Chadwick, of Oldham, will relate "Some Experiences with Leaky Tanks." Mr. T. Travers, of Cork, will offer some observations on "Gaseous Fuel;" Mr. Norton H. Humphrys, of Salisbury, will deal with "Some Special Applications of Gas;" Mr. T. Newbigging of Manchester, will discuss "Illuminating Power and Illuminating Effect;" Dr. C. B. Voisey will bring under the members' notice "An Improvement in the Construction of Atmospheric Gas-Burners;" Mr. W. Chew, will give an account of the progress of "Gas and Electric Lighting at Blackpool;" and Mr. George Anderson will put forward "A Plea for Differential Prices for Gas."

After all this business, the members and their friends will doubtless enjoy the excursion to Oxford, which has been arranged for the 22nd inst. It will comprise an inspection of the colleges and chapels under experienced guidance; a trip down the river by steam-launch to Nuneham, where, by the kind permission of Aubrey Harcourt, Esq. (obtained through the courtesy of Mr. J. Eldridge, of Oxford), the grounds and private gardens will be open for the inspection of members; and luncheon and tea at the Clarendon Hotel. As Paddington will be left at 9.30 a.m., and reached again soon after 9 p.m., the members, if the programme is fully carried out (as it doubtless will be), will have pleasantly spent the intervening twelve hours, which will have brought to a close the meeting of 1894.

Acting in consultation with Mr. West, the Evening Star Lodge intend holding an "Emergency" meeting on Monday evening, the 18th inst., at the Holborn Restaurant, in order not only to afford the members of the Institute who are Masons an opportunity when in London of greeting their President as a Mason, but to allow of the initiation of the Secretary of the Institute (Mr. F. G. Burfield) in the presence of as many of the "craft" as can make it convenient to attend. The well-known and highly popular "Meister Glee Singers" have been engaged to give a special performance after the dinner at the close of the Lodge.

THE MIDLAND ASSOCIATION AT CHELTENHAM.

The members of the Midland Association of Gas Managers met at Cheltenham last Thursday, and spent an exceedingly enjoyable day of blended business and pleasure. On arrival in the town, the party was received by the President of the Association—Mr. R. O. Paterson, Engineer and Manager of the Cheltenham Gas Company—and conducted first to his house, where light refreshments were provided. An adjournment was then made to the gas-works, where the formal business of the meeting, principally consisting of the reading of the minutes of the previous ordinary meeting and the election of new members, was transacted.* Before this was entered upon, however, the Association was welcomed to the town and the gas-works by Mr. Ticehurst, the Chairman of the Company, who, speaking in the name of the Board, gave the party kindly assurance of the pleasure he and his colleagues had in exercising towards the members the spirit of old English hospitality, with the possession of which the Cheltenham Directors have ever been credited. Mr. Charles Hunt fittingly replied on behalf of the Association; and then, without any unnecessary delay, Mr. Paterson proceeded to clear the *agenda*—accomplishing his task with a degree of facility and despatch that might well serve as a model for all Presidents of technical societies in similar circumstances.

The inspection in detail of the gas-works, which was next entered upon, had been looked forward to with keen interest by every gas manager present; for the Cheltenham undertaking is admittedly a model establishment. On this occasion it is safe to say that both those to whom the quality of Mr. Paterson's work was more or less familiar, and those to whom his style of gas-works management came as a revelation of the higher possibilities of the art, were fully gratified with all that was to be seen and heard. The hour and a half spent in these splendidly built and equipped works was indeed filled with an object-lesson in gas management which deeply impressed the Company's appreciative guests. There are many peculiarities in and about the Cheltenham works calculated to arrest the attention and arouse the reflective powers of the technical visitor; and Mr. Paterson's mastery of, and delight in, his really magnificent gas manufacturing station are worth a long pilgrimage to observe and to profit by. He can show splendid carbonizing results, specialities of many kinds, and a style of carrying out every operation of gas manufacture and distribution instinct with, and expressive of, a complete mastery of first principles and a marked individuality in applying them. His retort-settings are fired by some of the very best furnaces in existence; he dispenses with the hydraulic main; he cherishes an unshaken faith in steam-jet exhaustion; he practises sulphur purification without making a trouble of it; and, in short, in more respects than we have space for recounting here, the whole establishment is replete, indoors and out, with striking evidences that the excellent and low-priced gas supply of Cheltenham is made with brains as well as from coal—and to some extent from tar also. Of this latter point, however, we shall probably have to treat more fully on some future occasion.

It is pleasant to see, moreover, the thorough accord that prevails in Cheltenham between the Directors of the Company and their Manager. The Board are liberal, far-seeing, and public-spirited; and while they spend money freely in backing up the efforts of their Manager to give satisfaction to the proprietors of the Company and the public, he has the happy assurance that his devotion and his labours are most fully appreciated, and that his sphere of activity is not limited by any of the petty restrictions, false economies, and small meannesses that damp the spirit and hamper the efficiency of some of his less fortunately-placed colleagues.

Having thoroughly, if not exhaustively, examined the gas-works, the members of the Association were next driven through the town to the central gas-offices—a handsome and commodious pile of buildings, eminently calculated, in all respects, to be an ornament, as well as a convenience, to the locality. Thence the party was taken through the best parts of the district to the elegant suburbs, and so on through lovely scenery to the Cotswolds—enjoying the grand view of the fertile and historical Severn Valley, until the hamlet of Birdlip was reached. And here, up among the hills, a welcome and superlatively good dinner was provided by the kindness of the Directors of the Gas Company. The chair was taken by Mr. Skillicorne, the worthy son of the deservedly esteemed late Chairman of the Company, well remembered by the older members of the Association for his kindness on their last visit to Cheltenham, twelve years ago. After dinner, which was followed by a short businesslike toast-list, the return drive was taken by a different route leading through beautiful woods; and the town was reached in time for some of the party to catch a late train—others remaining the night. It was in all respects one of the pleasantest and most successful outings in the records of the Association, replete as these are with happy incidents of the kind.

Mr. Lewis T. Wright arrived in England last Sunday, on the termination of his engagement with the Buenos Ayres (New) Gas Company, Limited.

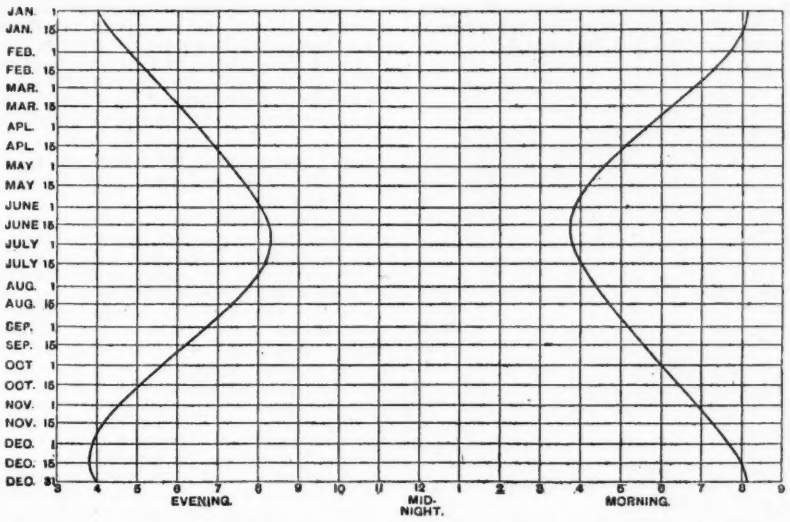
Official Changes.—Among the recent official changes in connection with gas undertakings, we have to record the following: Mr. R. T. Simpson, nephew of Mr. Peter Simpson, of Rugby, has obtained the appointment with the Guildford Gas Company till lately held by Mr. W. Longworth. Mr. Simpson was trained under his uncle; and he has been in the service of the Rugby Gas Company for about a quarter of a century. We understand that there were 81 applicants for the post, in reply to the advertisement which appeared in the JOURNAL for the 8th ult., according to which the duties will be "to superintend, and be responsible for, the laying of all mains and pipes, and all work in connection with the Company's business outside the Company's premises." In the same issue, the Directors of the Lewes Gas Company notified their desire to secure the services of an "experienced Manager." We learn that this has been satisfied by the appointment of Mr. Levi Monk, formerly of Colombo, and more recently Manager of the Maryhill (Glasgow) Gas-Works. The vacancy caused at Newport (I.W.) by the decease of Mr. Joseph Reed, as already announced in the JOURNAL, has been filled by the selection of Mr. F. G. Cockey as his successor. Mr. Cockey was a short time ago engaged at the gas-works at Shanghai, a description of which he communicated to our columns on Oct. 3 last year.

* The six new members thus added to the roll of the Association were: Mr. J. C. Bennett, of Bridgnorth; Mr. T. Burtonshaw, of Chipping Norton; Mr. Isaac Carr, of Widnes; Mr. F. W. Cross, of Wellington, Salop; Mr. C. Eastment, of Leominster; and Mr. George Helps, of Hinckley.

THE HOURS OF DARKNESS.

The accompanying diagram has been prepared by the *Electrician* as the result of inquiries addressed to different central station electric lighting companies in London, designed to ascertain the exact time for which artificial lighting is required throughout the year. The data for plotting the curves were obtained from the "load curves" of the stations, which show clearly enough the average time of lighting up for the district of supply. This, as determined by the unconscious vote of the majority of consumers, recorded by turning on their switch, is a few minutes before sunset all the year round; the acceleration for the winter months being only just perceptible. In the diagram, the space between the curved lines represents the time during which artificial light is required, in the latitude of London. The horizontal lines show the months of the year; the vertical lines, the hours. In the following table, computed from the time of sunset at different seasons of the year, is shown the duration of lighting to be provided for different classes of consumption:—

Hours of Lighting.	Period of the Year during which Light is required at these Hours.	Total Number of Hours of Lighting per Annum.
6 a.m. till daylight . .	..	250
Dusk „ 5.0 p.m. . .	Oct. 18 to Feb. 8	83
„ „ 6.0 „ . .	Sept. 21 „ Feb. 14	226
„ „ 6.30 „ . .	Sept. 8 „ April 1	320
„ „ 7.0 „ . .	Aug. 25 „ April 19	430
„ „ 7.30 „ . .	Aug. 10 „ May 7	560
„ „ 8.0 „ . .	July 23 „ May 28	730
„ „ 8.30 „ . .	All the year	900
„ „ 9.0 „ . .	„ „ „	1090
„ „ 10.0 „ . .	„ „ „	1455
„ „ 11.0 „ . .	„ „ „	1820
„ „ midnight . .	„ „ „	2185
„ „ 2.15 a.m. . .	„ „ „	3000
All night	„ „ „	4380



THE SAND FILTRATION OF WATER SUPPLIES.

A good deal of attention has been attracted lately to the experiments carried out at Lawrence, Massachusetts, upon the sand filtration of drinking water for the removal of bacteria, to which reference has already been made in the JOURNAL. Full particulars of the filtering plant which is the outcome of these interesting experiments were a short time since given in the *Engineering Magazine*, in an article by Mr. G. W. Fuller. As the writer observes, the possibility of procuring an ideally pure supply of water is becoming farther and farther removed from many towns as countries grow in population, so that the number of these towns that are obliged to face the problem of how best to remove disease-producing germs from a polluted water is large, and the number is rapidly increasing. It is believed that properly-conducted sand filtration contains the answer to this question. This method of treating water was first introduced in London by James Simpson in 1839; and it is described as consisting in passing the water through fields of thoroughly under-drained sand, the surface of which is kept constantly covered with water. The efficacy of this system in connection with the water supply of London has been testified to by Professor Percy Frankland, and proved by the lowness of the average death rate from typhoid fever. Our knowledge of the effects of sand filtration has also been largely extended by the observations of Piefke and the bacteriologists of the Hygienic Institute of Berlin upon the filters used for the water supply of the German capital. It appears that the State of Massachusetts, earlier than most other American States, found difficulty in obtaining sufficient quantities of pure drinking water, particularly for the larger cities of the East. Thus the question of purifying these waters assumed capital importance; typhoid fever having become endemic in Lowell, Lawrence, and other Massachusetts cities. Accordingly, filtration experiments were made under the auspices of the State Board of Health; and these bore fruit in the establishment for the city of Lawrence of a system of sand filters, described by Mr. Fuller, which differ from the English system in being intermittent. The surface of the sand is left to dry every day, or at least the pores of the sand are allowed to fill themselves with air once a day. This is believed to facilitate oxidation; and to remove more of the organic matter that accumulates on the surface of the sand. The top skin of sand is scraped off once a month and replaced. The bacteriological efficiency of the filter is stated at 99·5 per cent. Mr. Fuller gives a table of average death-rates, and percentages of deaths from typhoid fever to total deaths in eight large cities, rom which it appears that sand filtration has been a great protection to London and Berlin. For the four years from 1887 to 1891 inclusive, the typhoid death rate per 10,000 inhabitants was 1·30 and 1·46 for Berlin and London, while even for Glasgow, with its water supply drawn from a distant and uncontaminated mountain lake, it was 1·78, and for Chicago, 8·26. A still more striking proof of the efficiency of sand filtration, is afforded by the cholera records of Hamburg and Altona in 1892, already alluded to in the JOURNAL. Both of these neighbouring cities are on the Elbe; but whereas Hamburg, with its intake above the city, supplied unfiltered water, Altona took water from the river at a point below the outflow of both the Hamburg and Altona sewers, but filtered it carefully before using. The relative proportions of cholera cases in the two cities per 10,000 inhabitants in 1892 was: Hamburg, 290; Altona, 40—the latter including many imported cases.

Books Received.—"Practical Hints on the Construction and Working of Regenerator Furnaces," by Maurice Graham, Assoc.M.Inst.C.E. (London: E. and F. N. Spon.) This little book is an elementary explanatory treatise on the system of gaseous firing applicable to settings of horizontal or inclined retorts.——"Micro-Organisms in Water: Their Significance, Identification, and Removal; together with an Account of the Bacteriological Methods Employed in their Investigation. Specially Designed for the Use of those connected with the Sanitary Aspects of Water Supply." By Percy Frankland, Ph. D., B.Sc. (Lond.), F.R.S., &c., and Mrs. Percy Frankland. (London: Longmans, Green, and Co.).——"Theory and Construction of a Rational Heat Motor." By Rudolf Diesel. Translated from the German by Bryan Donkin, M.Inst.C.E. (London: E. and F. N. Spon.)

The Foreign Reports of the Labour Commission.—Whatever may be the result to the community at large of the long inquiry conducted by the Royal Commission on Labour, students of industrial questions will have reason to be thankful for the valuable series of reports on the conditions of labour in foreign countries which have been produced under the supervision of the Secretary to the Commission (Mr. Geoffrey Drage). These reports have on more than one occasion been dealt with in our columns; and the issue of the last—on Austria-Hungary and the Balkan States—is sufficient justification for again directing attention to them. In submitting this volume, which contains an excellent account of Socialism in Austria, Mr. Drage says that it forms the completion of the first attempt made in any country to deal with the whole of the literature of foreign countries, official and unofficial, upon the labour question; and that, in spite of close criticism in the countries of which he has treated, practically none of his facts, figures, or conclusions have been disputed. When this is borne in mind, and when the difficulties to be overcome and the time at disposal are considered, it will be conceded that Mr. Drage is entitled to hearty congratulations on the successful accomplishment of a very arduous task.

REGISTER OF PATENTS.

Coin-Freed Check Mechanism for Gas-Meters.—Jones, J. L., of Newport, Mon. No. 10,075; May 20, 1893.

One of the improvements comprised in this invention consists (as shown in the engravings) in means for connecting and disconnecting the meter index mechanism and the main ratchet-wheel A, employed in certain arrangements of check mechanism. To accomplish this, a circular rack is provided on the upper face of the main ratchet-wheel; while above it, and lying on the face thereof, is the disc B, having teeth on its under face. When the meter is out of action, the clamping-disc B is pressed firmly down into gear with the rack, by means of the spring C acting upwardly on an arm, pivoted to a suitable support fixed in the bed-plate D of the mechanism. When, after the insertion of a coin in the slot E, the check mechanism is put in action, the disc is raised so that its teeth are lifted out of gear with the rack of the ratchet-wheel A. When raised, the disc and the usual index-pinion F (fig. 2) carried on the sleeve surrounding the index-pointer spindle G, cannot rotate with the ratchet-wheel; and hence no strain is thrown upon the index gearing by the disc. When, however, the disc B is lowered upon the ratchet-wheel, the latter, the disc, and the index-pinion rotate together until the quantity of gas paid for is consumed. There is a brake to prevent too free rotation of the wheel A.

Fig. 1.

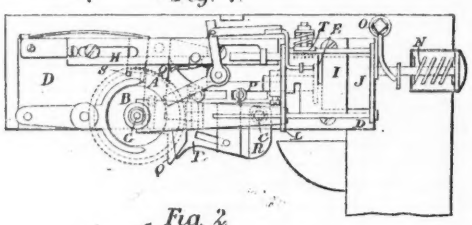


Fig. 2.

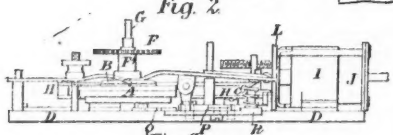
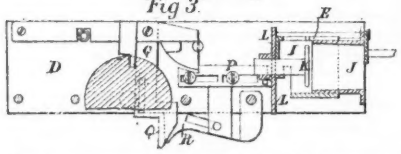


Fig 3.



A further improvement comprised in this invention consists in the mechanism whereby the ratchet-wheel A is, through the medium of the usual slide H, fitted with ordinary spring pawls, operated after introduction of the proper coin into the slot E. Fitting the barrel I (screwed or otherwise fixed to the bed-plate D) is a cylindrical cap J, capable of being easily moved backwards and forwards in the barrel. The slot E for the introduction of coins is cut in the barrel I. The coin, when introduced, lies vertically between the inner end of the cap J and a piston K, fixed on the end of the spindle connected to the moveable crosshead L. The latter is adjustably connected to the usual slide H through an adjusting screw, as usual.

By the spring N, the cap J, the crosshead L, and slide H are normally held back, as shown; but when, after the introduction of a coin, the spindle O is turned, so as to cause its arm to exert sufficient pressure inwardly on the cap J, the spring is compressed, and the cap advanced in the barrel I, pushing the coin before it, and accordingly moving the crosshead L and slide H. The pawls are thus put into engagement with the ratchet-wheel A; and the latter (being freed) is turned to the extent determined by the adjustment of the slide, according to the quantity of gas to be supplied for the coin. The latter being, at the completion of the forward stroke, carried beyond the edge of the chamber I, and consequently being now unsupported, drops out of the barrel I into a tray, and thence slides down into the chamber below. The crosshead L in advancing, as described, travels over the rib formed on the upper face of the arm. The spring C, normally keeping the tail of the arm raised, is compressed; and the arm is tilted so as to cause the toothed disc B to rise above the rack of the ratchet-wheel, which is thus made free to be turned by the pawls

A further effect of the advance of the crosshead is to push forward the slotted bar P connected to it; and this bar, acting through cam and lever, causes a stop-lever to be lifted, so as to raise the finger shown out of a socket provided for it in the disc at the back of the ratchet-wheel A. The position of this socket in the disc is such that, when the finger of the stop-lever is in it, the index-pointer on the spindle G points to zero on the index-dial. In rising, the lever carries up the arm G pivoted to it. This arm, when lowered, bears against he tangent of the meter, and obstructs its action and prevents it from supplying gas. Consequently, when the ratchet-wheel A is free to rotate, and the arm G is raised to liberate the tangent, the meter is free to supply gas. In order to ensure that a supply of gas shall not commence until the coin has passed out of the barrel I into the tray, a second tangent stop-arm R is employed. This arm is pivoted to the bed-plate D, and is slotted to take a pin by which connection is made between the arm R and an arm branching from the slotted bar P. The arrangement is such that as, in the advance of the slotted bar, the arm Q is raised to clear the tangent; and to lift the finger out of the socket in the disc, the second stop-arm R is tilted down to take the place of the arm Q, and to restrain the tangent and keep the meter out of action. As soon, however, as the coin has passed out of the barrel I, the crosshead L is returned by the spring N to its normal position; the arm R is raised, so as to free the tangent; and the meter is set in action to supply gas. The finger having been raised, and the ratchet-wheel A moved to the extent of the forward stroke, it follows that, when the backward stroke is made, the socket is not below the finger, which now rests on the periphery of the disc, where it remains until the ratchet-wheel returns to indicate zero. It then again falls into the socket presented to it.

In order to prevent the ratchet-wheel A from being turned by a succession of strokes through a complete revolution, a stop S is provided on the face of the ratchet-wheel; and, if the ratchet-wheel be turned sufficiently, the stop makes contact with one arm of a crank, and moves a bar, which is thus shot across and obstructs the slot E. A spring returns the bar and crank to their normal positions, when the stop S is withdrawn, which takes place simultaneously with the commencement of the supply of gas.

To prevent a coin, when once introduced into the slot, from being advanced and returned in the barrel without leaving it, a rack T, acted upon by a spring, is fitted to the barrel. This rack is raised by the advancing coin, which is thereby gripped under the action of the spring; and the mechanism is inoperative until the coin has been ejected from the barrel I, and the backward stroke completed.

The cap J corresponds in outer diameter with that of a coin of the size for which the apparatus is constructed. Consequently, if an undersized coin be introduced, its upper edge will be at a lower level than the leading end of the top part of the cap. Therefore, the coin will, at the lower edge, be gripped between the piston K and the lower part of the cap J, and will thus become tilted back into the cap, which is partially open at the rear end (as seen at fig. 3). The rejected undersized coins then pass out through the opening at the back of the cap

Starting Gas-Engines by Means of Steam under Pressure.—Hartley, J. W., and Kerr, J., of Kilmarnock, N.B. No. 13,310 May 24, 1893.

The patentees propose, in starting gas-engines, to introduce steam under considerable pressure into the explosion-space, by means of a cock which, by its ample area, will admit the steam rapidly. The cock is operated either automatically or by hand, so as to admit the steam each stroke or each alternate stroke, and thus drive forward the piston until the engine has attained sufficient speed for starting to work. By disconnecting the air and gas inlet valve (which thereby remains closed), the lifting cam slides axially along the side shaft; and with engines working on the "Otto" cycle, the ordinary exhaust cam slides along the shaft, and is replaced with a two-lift cam, which lifts the exhaust-valve once at each revolution of the engine, instead of every alternate revolution as in ordinary working. By this latter device, an impulse is obtained at each revolution of the engine, so as more easily to get up the required speed. In engines using Dowson gas, the steam is taken from the boiler employed for generating the gas; and there is a receiver close to the cylinder. In a double-acting "Otto" cycle engine, the steam is introduced at one end only of the cylinder, in the manner described; the other end operating with gas in the ordinary way. As soon as the engine is "under way," the cams are replaced in their normal position, and the engine works in the usual manner.

In operating the steam-cock automatically, it is proposed to make use of the double-lift cam which operates the exhaust-lever, the cam roller being arranged to open the valve or cock during the outstroke of the piston. In constructing cams for lifting gas-engine valves, it is of advantage, say the patentees, that they be easily and readily removable; and in the case of such cams as are revolved upon the shaft by a helix, it is well to also arrange them to be carried in ball-bearings, whereby they can be controlled by the governor with the least amount of friction. To this end, there is fixed on the side shaft, upon one side of the loose cam, a fast collar having on its side face a groove concentric with the axis of the shaft, and forming one portion of the seat for the balls to work upon. A second corresponding ring adjoins, and forms the opposing seat for the balls. The face of this second ring farthest from the ball bearings is grooved; and the cam proper is cut in halves, and arranged with a tongue or projection fitting into the groove in the second loose ring. A corresponding ring to the second ring follows, and retains the two halves of the removable cam in position; the balls and the seating being on the farther side of the ring from the removable cam. By sliding away one of these rings, the cam can be at once removed without taking down the shaft.

Treating the Waste from Gas Liquor.—Crowther, H. W., of West Bromwich. No. 11,964; June 17, 1893.

This invention refers to the treatment of the waste liquor left after the distillation of ammonia from gas liquor, "to obtain therefrom a sulphocyanide of an alkali or of an alkaline earth, by adding precipitated cuprous oxide to the waste liquor, thereby forming cuprous sulphocyanide, and then further treating the cuprous sulphocyanide with an alkali or alkaline earth."

In his specification (which is not illustrated), the patentee says: "After the liquor is run from the still, I allow the lime to settle, which takes place rapidly; and whilst the liquor is still hot, I neutralize the lime in solution, by passing through it gases containing carbonic acid—preferably lime-kiln gases. I thereby obtain a precipitate of carbonate of lime, which I allow to settle. Having separated the clear liquor, I add precipitated cuprous oxide mixed with water to a creamy consistence. This I add in quantity not quite sufficient to decompose all the sulphocyanide present; and I then add an acid—in this case preferably muriatic acid—in such quantity that the liquor shall at the end of the operation have a slightly acid re-action. The mixture is agitated; and after a few minutes, it will be found that the cuprous oxide has decomposed the soluble sulphocyanide, with formation of insoluble cuprous sulphocyanide; while the base of the soluble sulphocyanide contained in the liquor operated upon has combined with the muriatic acid to form chloride of calcium. When the re-action is finished, the precipitate of cuprous sulphocyanide is allowed to subside; and the bulk of the liquor is run off. The cuprous sulphocyanide is then brought on to a filter and washed, to remove any soluble impurity. The insoluble sulphocyanide of copper thus obtained is used for the production of the sulphocyanide of the alkali or

alkaline earth it is desired to produce, by adding such alkali as hydrate or carbonate—preferably hydrate, or alkaline earth as oxide, or hydrate and water—and boiling. As the result of this operation, the required sulphocyanide is obtained in solution; while hydrated cuprous oxide is precipitated, and is separated, preferably by settling. The cuprous oxide is used for another precipitation of sulphocyanide from other waste liquor."

Explanatory of the proposal, the inventor remarks that it has before been proposed in the purification of soap leys, and among other operations, to add to the leys a solution of a copper salt, and thereby to precipitate impurities, among which are sulphocyanides. He, on the contrary, in the treatment of the waste from gas liquor, adds to this liquor precipitated cuprous oxide, in a moist or creamy condition, which for his purpose is much more suitable, and which in the working of the process is being constantly reproduced and re-used. The preliminary neutralization of the liquor with carbonic acid gas—thereby producing a precipitate of carbonate of lime—is also claimed as a novel feature of the invention.

Charging Retorts.—Fiddes, W., of Bristol. No. 12,084; June 20, 1893.

This invention refers to "a steam or air blast shoot, for propelling coals into through retorts."

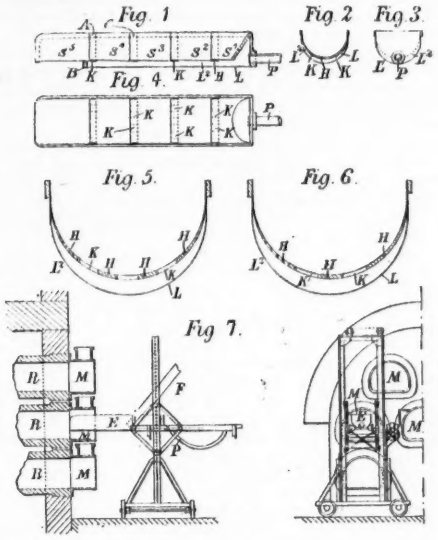


Fig. 1 is a longitudinal section of the apparatus; and fig. 2 is a section on the line C D of fig. 1. Fig. 3 is a rear end elevation; and fig. 4 is a plan of the apparatus. Figs. 5 and 6 are enlarged sections taken on the lines A B and C D of fig. 1.

Fig. 7 is a side elevation and a back elevation of the apparatus (marked E), showing how it may be mounted on moveable framework, to be readily brought into position to charge the retorts R.

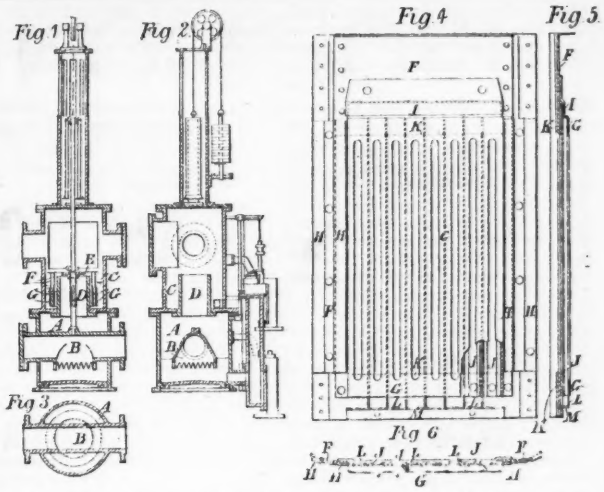
The coals would fall from a hopper or hoppers (placed in any elevated position, preferably above and in front of the retorts) down a shoot F, and into the apparatus E, which consists of a series of short shoots S^1 S^2 S^3 S^4 S^5, the forward end of each overlapping the hinder end of the one in advance of it, and fixed by distance-pieces H, so that spaces K are left at the rear of each shoot. The lower side of the shoots is encased with a jacket L; and into the chamber L^2 thus formed, there is admitted by the pipe P steam or air under pressure, which escapes as a series of blasts through the passages K at the rear of the shoots.

In charging the retorts, the apparatus is brought in front of the mouthpieces M; and, if desired, some portion of its length may be inserted into them. Coal is then allowed to fall down the shoot F into that end of the apparatus E which is farthest from the retort; and at the same time (or prior to it) the steam or air is turned on by the pipe P. The coals falling from the shoot F into the apparatus meet with a blast of steam or air issuing from the first set of spaces K beneath the shoot at S^1. The blast carries the coal forward, where it meets with the blast from the second set of passages K beneath the shoot at S^2; and so on with regard to the remainder of the spaces or passages until the coal is finally projected into the retort.

Washing and Purifying Gas.—Marshall, F. D., of Copenhagen. No. 22,576; Nov. 24, 1893.

This invention, relating to apparatus for removing tar and ammonia from coal gas, refers more especially to the apparatus known as Drory's tar-washer. This comprises a washing chamber placed at the bottom of the apparatus, and having passing through or formed within it a pipe, having a downwardly projecting opening, closed by a water seal. The gas which enters the washing chamber has thus to pass through the water, so that the ammonia and a portion of the tar are extracted; and an impact chamber is formed communicating with the washing chamber through a vertical tube over which a tar-extracting bell is placed.

According to the present invention, this tar-extracting bell is formed with two concentric frames, having the walls carried thereby made in sections; each section being provided with a series of vertical slits or openings. In front of these openings is placed a plate, having similar slits or openings so arranged that they are out of line with the other set. In the first-mentioned slits or openings, vertical bars are placed in such a manner that the gas which passes through will be divided into two streams, and be caused to impinge against the opposing or second plate, so that the gas in flowing through the sections will deposit its tar upon the opposing surfaces.



Figs. 1 and 2 are central vertical sections (at right angles to each other) of a Drory tar-washer having these improvements applied thereto—certain parts shown in fig. 1 being omitted from fig. 2. Fig. 3 is a section of fig. 1. Fig. 4 is an elevation (drawn to an enlarged scale) of one of the sections of the tar-extracting bell. Figs. 5 and 6 are sections of fig. 4.

A is the washing chamber; B, the pipe having the downwardly projecting opening therein; and C, the impact chamber connected with the washing chamber through the vertical pipe D. All of these parts are of ordinary construction. E is the improved tar-extracting bell, which is advantageously made of octagonal shape, and provided with two concentric frames F, each carrying eight wall sections. Each section comprises a front plate G, the sides of which are flanged and adapted to slide in guides H formed in the octagonal framing of the bell (see fig. 6), and the top edge of which is also adapted to pass beneath or behind the plate I, as in figs. 4 and 5—the plate being riveted to the frame. Behind the plate is placed a series of channelled bars J, so arranged that spaces forming slits are left between their adjacent edges, and also between their edges and the plate. These bars J are held in position by riveting them to two cross-bars K, which are themselves riveted to the plate G. In the spaces between the adjacent edges of the channelled bars are fixed metallic strips L, serving to divide the streams of gas issuing between the channelled bars. These strips when inserted are held in place by a piece of angle-iron M, secured to the frame as shown in figs. 4 and 5.

The bell is carried in the usual manner by a rod, the weight of which, together with the bell, is counterbalanced, so that the bell is alternately immersed in and lifted out of the water surrounding the vertical pipe D, in the ordinary way.

Gas-Engines.—Bénier, L., of Paris. No. 1581; Jan. 24, 1894.

This invention relates to an engine specially constructed to be operated by poor gas—the operation of the generator in which the gas is formed entirely depending on the engine; for "the latter sucks the mixture of air and steam which enters the furnace of the gas-generator in order to form the gas."

The air and gas are sucked in at each revolution of the shaft by pumps; the air passing through one valve, and the gas through another. The air and the gas pass into the engine cylinder through a third valve, where the mixing takes place. The discharge takes place naturally, while the piston uncovers orifices during about five-sixths of its forward stroke. Therefore the orifices remain open during the last sixth of the forward stroke, and during the first sixth of the backward stroke. During this time, the piston of the pumps (which is actuated by a crank forming an angle of 90° with the crank of the engine) has forced into the engine cylinder the air and gas which have been sucked. This mixture, on entering, passes through a pipe provided at the centre of the cylinder cover; and it traverses small plates, which have for their object to cause the current of the mixture to take the section of the cylinder, so as to completely drive away the burnt gases which fill the cylinder. The engine-piston returning to the rear, after it has covered the discharge orifices, compresses the mixture introduced, until it reaches the end of its rear stroke. At this moment, the explosion takes place; and the expanding gases push the engine-piston in its forward stroke, until the discharge orifices open, when the same operations re-commence.

In order that the replacement of the burnt gases by the fresh mixture may "be effected under economical conditions, without loss of gas by escape," it is necessary that the first portions delivered by the pumps shall not contain gas, but only pure air, which comes in contact with the burnt gases and drives them away. As the two pumps operate together, the gas-pump must commence by delivering pure air like the air-pump. This is obtained in the following manner: The two pumps are in constant communication, by means of their delivery-pipes, through the interior of the valve-box. A valve is placed upon the gas-delivery pipe to prevent the gas-pump being filled with air during the suction; the air entering more easily than the gas, which has to traverse the whole gas-generator. By incompletely closing this valve during the suction, a certain quantity of air is only permitted to pass into the gas-pump; this quantity being limited to the volume necessary for filling the delivery-pipe. Thus, when the piston of the pumps commences the delivery, only air will at first pass into the engine cylinder, until the air contained in the gas-delivery pipe has been driven away. Then, for forming the explosive mixture, gas and air enter in suitable proportions, which are determined by the section of the cylinders of the pumps. The gas-pump and the air-pump having approximately the same volume, the gas-pump sucks in

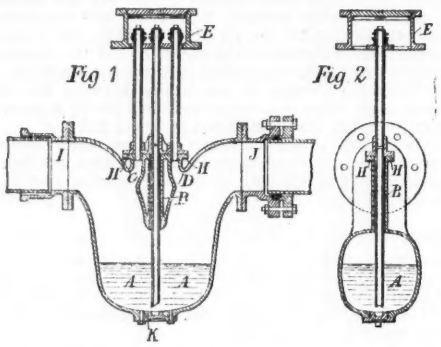
each stroke a certain volume of gas, and delivers it directly into the engine-cylinder; and this suction causes the admission into the gas-generator of an equivalent quantity of air and steam, which traverse the furnace of the generator—the quantity being varied by the governor.

Propelling, Forcing, or Exhausting Gas.—Groombridge, C., and South, W. A., of New Bond Street, W. No. 4430; March 2, 1894.

This invention is designed to provide apparatus which shall be capable "of exerting great propelling or forcing, or great exhausting power," by employing a rotary disc having apertures, in which are mounted feathering or swivelling vanes, acting as pistons, and working in an annular casing or chamber formed with a diaphragm or partition, for preventing the return to the inlet of the air drawn into the apparatus. The vanes are mounted on spindles, provided with cranks or arms, which engage in a cam groove or path formed in the cylindrical surface of a stationary boss, arranged concentrically with the annular disc. The shape of this cam groove or path is such as to keep the vanes at right angles to the disc during a portion of each revolution, but to cause them to feather or swivel, and lie flush with the surface of the disc in the apertures therein, and so enable them to pass through the diaphragm or partition. The annular casing is preferably formed in two parts, situated on opposite sides of the disc; and the diaphragm, which is preferably of V shape in cross section, consists of two internal projections, cast one on each of the halves. Thus, when the casing is fitted together, a gap or space is left between them, to allow of the passage of the disc and vanes in their movement of rotation. The gap or space is, however, in reality, always filled by the rotary disc or a vane therein; and it thus prevents the air returning to the inlet.

Syphon Test-Boxes for Gas-Mains.—Bouvier, A., of Lyons, France. No. 6359; March 29, 1894.

As shown in the engraving, the inside chamber or box A of the syphon is U-shaped, and is divided into two separate parts by a partition cast with the box. Each of the vertical tubes B C D receives a pipe; and fixed in the central tube B, is a prolongation, bevelled at its lower end, and dipping to the bottom of the box A, so as to introduce water into the syphon when required. The tubes C and D, with their respective pipes, serve for the passage of gas when testing the tightness of the mains. E is an inspection box with a cover, beneath which is the syphon. H is a horizontal plate connecting the three tubes B C D. I J are lateral tubes or junction-pieces, serving to connect the syphon to the main. K is a plug in the bottom of the box.



Leaks are searched for in the following manner: A given section of the main being isolated from the rest of the system, by means of one or more syphon-boxes previously filled with water (as shown in fig. 1), the operator would bring up a portable gasholder mounted on wheels. Assuming that the pipe I, and consequently also the tube C and the small pipe attached to it, communicate with the side where the gas is supplied from the gas-works under the usual day pressure, and that the pipe at J, and consequently the tube D and its small pipe, communicate with the isolated section, all the supply branches from this section would cease to supply gas to the consumers of this section. The supply-pipe of the holder would be connected by an india-rubber pipe with the pipe from C. The bell of the holder would rise owing to its flotation; and would be filled with gas under pressure. When it is full, the supply-pipe at C would be closed; and the exit-pipe of the small holder would be connected with the pipe D of the syphon, and thus with the section to be tested.

In regard to his proposal, the patentee says: "I introduce this gas under pressure into the isolated section; and the bell first descends a certain distance by reason of this. Afterwards, if there are leaks in this section, the bell descends at a rate proportional to the size of the leaks. I note how many litres of gas escape per minute from each section under the testing pressure of (say) 100 millimetres. I am thus enabled to know in figures the relative tightness of each section, under conditions which augment the sensibility of the test and the precision of the measure. I know where the leaks are, and their importance; and it is thus easy to repair them."

APPLICATIONS FOR LETTERS PATENT.

9844.—Jerram, A. E., "Gas and oil engines." May 21.
9872.—De Beaux, P., "Regulating devices for incandescent gas-lamps." May 21.
9875.—Hawkins, L. B., "Burners for incandescent gas-lamps." May 21.
9913.—Thompson, W. P., "Separating gases." May 22.
10,022.—Thomson, J., "Meters for liquids." May 23.
10,063.—Foster, W. H., and Nunns, F., "Gas-governors." May 24.
10,110.—Good, R., and Spencer, S., "Removing deposits from gas-retorts." May 24.
10,113.—Holt, H. P., "Gas motor engines." May 24.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Settings of Inclined Retorts at Coventry.

Sir,—Owing to unavoidable absence from the recent meeting of the Incorporated Institution of Gas Engineers, I should like, with your permission, to offer a few remarks in the Journal in reply to Mr. Frank Livesey's paper on "Stoking Machinery or Inclined Retorts," given in your issue for May 22 (p. 955).

Although the particulars and figures taken by Mr. Livesey from the paper read by me last year are true in substance and in fact, there are many qualifying features connected with the erection at Coventry which, when known, will alter materially the aspect thrown upon it in point of costs, &c. The statements made told only the facts as applied to our erection at Coventry; and therefore I do not think these ought to be taken as a basis to work upon in forming a judgment in such an important matter as the comparison of cost between inclined retorts and stoking machinery. It would seem only fair that an average cost of a retort should have been taken from the many installations erected in this country during the past two years. If this had been done, the possible figure would be from £73 to £75 as an average cost per 15-feet retort, all told, for large erections on the incline.

In my own case, the foundations were exceptionally difficult and costly (such as are rarely, if ever, met with). Also, during the formation of the subways, it was thought desirable to prepare for a double line of bench—thus materially affecting the cost; the latter covering the subway, excavations and formations of same, floors, and superstructure, building retaining wall, approaches to subway, and taking down an old retort house and bench.

When giving the paper, it was never thought comparisons would be made based upon the figures there stated, and used against inclined retorts in favour of machinery. If the value of the two systems had been taken and placed against each other, assuming they were for use on my works, then I say the application of stoking machinery would be out of the question.

Now with regard to the carbonizing power on the area named. The height of the house will permit (if we feel so disposed) of an erection of arches each to hold 12 retorts or more; the elevating and charging arrangements standing good for the purpose. The coaling arrangements can be placed end-on to the bench, and tanks of a continuous kind erected (if thought advisable); and I see no reason why we may not just as well carbonize on the same area 400 tons as 200 tons of coal per diem—thus substantiating my statement that "there is no retort-house erected at present, and filled with retorts on the horizontal system, capable of turning out a like quantity of gas per foot of space occupied as by this arrangement," &c. The number of retorts in one arch is not a limited one; and I may say that 14 retorts in one arch is no new thing—having had such in use, heated with one fire, making from 13,000 to 15,000 cubic feet of gas per mouthpiece per day. Naturally it will be seen that such erections on the horizontal necessitate a moveable second stage. This would prove a costly, awkward, and almost unwieldy piece of apparatus to have in a retort-house.

I think there is some misunderstanding as to costs of working at Coventry. The whole charges for carbonizing, including elevating the coal, all attention to fires, &c., to the time the coke is trimmed in the yard, are covered by 18d. per ton—the figure named in the paper.

Mr. Livesey speaks also of the prices paid in Coventry. To this I reply that they are as high as, if not higher than, those paid in London. Then, again, as to wear and tear. We find it no greater than with horizontal settings, the material for the setting is no more costly, no skilled mechanics are required to repair the machinery, and, in fact, there are scarcely any repairs necessary. We also find the tools in use for the inclined system do not cost anything like the amount of those used on the horizontal settings.

We have now had this installation in work over two years; and I see no reason to alter my statements approving the system, but rather to more strongly press it forward, and further to maintain that, with proper arrangements, adjustments of work, both internally and externally, there is not the least fear of being non-successful on all the points raised as difficult and unworkable. The heating can be made perfect, and practice shows that the erections can be carried out just as easily on this principle as on the horizontal; and if the gauntlet is thrown down as to the system lending itself best to the erection of the greatest number of retorts which can be effectually and with the least cost manipulated in a retort-house of given area, then I say the inclined system. With this you have in your hands a power which would run stoking-machines off the field altogether, as now applied to our horizontal settings. You would, in such an erection, get cleanliness, no cumbrous second travelling stage in order to manipulate your upper tiers of retorts, and many other advantages.

Experience has taught some users that special appliances are needful for the easy and efficient working of inclined settings; but if these are to be ignored and substituted by others which go against all experience, the system should not, I think, be quite put under the earth because it has not been so successful as one would wish during its trial in a few undertakings.

I thank Mr. Livesey for his attention and use of my figures; and I hope the discussion, which seems to have taken a course against him, and in favour of the inclined system, will somewhat modify his ideas.

Coventry, May 26, 1894. G. Winstanley.

The Trade in Gas Appliances.

Sir,—With reference to the correspondence in the Journal on the above subject, under the heading "Gas as a Fuel," "Gas Monopolies, and the Hire System," &c., initiated by Dr. Pullar's letter, in the number for the 24th of April, the latter purported to be a statement of the case with respect to four interests, and constituted an attack on the policy adopted by gas companies. As a unit among the vast numbers adversely affected by the existing system, we have scanned the columns of your subsequent issues for replies from the parties whose policy is assailed;

but we note that they are "conspicuous by their absence." We notice, however, that an attempted defence is set up by a representative of an interest not alluded to by Dr. Pullar (which may be described as the fifth, or monopoly in manufacture)—namely, Mr. Thomas Fletcher, who in this capacity naturally regards the present state of affairs with complacency, and consequently deprecates any alteration tending to throw open the close borough now in the possession of his own and a few other firms constituting the fifth interest. Mr. Fletcher's remarks, therefore, are all in favour of a continuance of the existing system, from which his firm reaps such enormous benefits. But let him change places for a few months with a manufacturer outside the pale of this preserve, or with a vendor of appliances attempting to compete with a powerful rival offering 30 per cent. discount to the customer, and his content would very soon disappear and be replaced by a keen desire for a more equitable state of things.

In his letter in last Tuesday's JOURNAL, Mr. Fletcher quotes an extract, apparently taken from a communication of our own on this subject to *London*, as follows: "The trade in gas appliances by ironmongers, &c., in this country has practically disappeared under the influence of this great monopoly by gas companies and corporations." The truth of this Mr. Fletcher denies. Against this denial, we call your attention to a letter which we drew up and circulated for signature among the leading London houses, whose trade should include the vending of appliances, as follows:—

To the Editor of "The Ironmonger."

SIR,—Referring to the correspondence in your columns on the above subject, we endorse your comments of May 5, and consider the position of affairs with regard to the competition by gas companies warrants a meeting of the trade being called to discuss what steps should be taken to obtain redress—Yours faithfully,

(The Editor's comments referred to are an endorsement of Dr. Pullar's statement of the case.) The above was at once freely signed. The firms thus represented include almost all the most important houses in the trade; while all, without exception, are in accord as to the impossibility of selling under the existing competition. Of course, this proof is confined to London only; but a canvass in the provinces would produce similar results wherever this competition exists, but especially where it is conducted on the unfair lines specified.

Mr. Fletcher's experience as to the increase in this trade by ironmongers, &c., has no bearing on the case generally, but is, as Dr. Pullar states in his reply, dated May 2, to Mr. Fletcher's letter of April 26, simply an evidence of the benefits accruing to the fifth interest outside, but as a sequence of, their trade with the gas companies, as the trade still carried on in the proper channels consists of the dregs left by the companies, and is naturally, for the most part, confined to the goods advertised by them. No one denies that this outside trade still exists, and possibly even shows an increase to the *fifth* interest; but the percentage this residue bears to the whole is ever diminishing, and will finally disappear under the absorbing influence of the companies.

It seems almost puerile to reiterate these well-known facts, as the companies are as well aware of the injurious effects of their policy as the trade themselves. But the conclusion appears to be that the companies must give something away to attract customers; and there is really no objection to this, provided, however, they are generous with their own instead of other people's property. Let them therefore employ some of their profits in reducing the price of gas; or, if they cannot see their way to this, let them conduct the appliances department on business lines, and devote to this same desirable object the profits accruing. They would then allow the trade to live (as legitimate competition harms no one), increase the number of their consumers, and at the same time benefit themselves.

70, *Berners Street, W., May* 30, 1894. HERSEY BROS., LIMITED.

Stoppage of the Dewsbury and Heckmondwike Water Supply.—Owing to the bursting of one of the pipes of the main conduit of the Dewsbury and Heckmondwike Water-Works at Cleggford Bridge, the supply of water to the two towns, and also to Ravensthorpe, Ossett, and Soothill Nether, was temporarily stopped last week; but it was expected that the repairs would be effected by noon on Friday.

New Pumping-Engines for the Newcastle and Gateshead Water Company.—The Newcastle and Gateshead Water Company have now completed the erection, at their Wylam station, of two pairs of pumping-engines, made by Tangyes Limited, to deliver 3,000,000 gallons of water per day. They were inspected in operation recently by several of the Directors, including the Engineer (Mr. J. R. Forster), all of whom were highly pleased with the performance of this latest addition to their pumping plant. The pumps are of the direct-acting horizontal type; and, by an ingenious mechanical contrivance, are arranged so that each pair can be worked simultaneously, or any single pump independently of its neighbour.

Plymouth Water Supply.—There has been some controversy at Plymouth of late in reference to an increase of the local rates; and at the last meeting of the Town Council the Town Clerk made a statement on the subject. In the course of it, he said the Corporation had raised £86,000 in connection with the water supply; and the interest on this which was provided for in the estimates for the present year amounted to £2580, or equivalent to a rate of 2d. in the pound. But there were applications for new water supplies; and an agreement had been entered into with the Devonport Water Company to let them have any surplus water. He had, therefore, great hopes of the result of this expenditure; and he would take any measure of responsibility for having advised it. Subsequently Mr. Bond moved the adoption of the minutes of the Water Committee, who reported that the agreement with the Devonport Company provided that the Corporation should supply all their customers for the time being in priority to the Company's supply. Referring to the estimated expenditure on water-works account, Mr. Bond said that, while in 1891 it was £4900, it was now reduced to £3500, notwithstanding that they had a bigger property to administer. The receipts, which in 1891 were reckoned at £13,800, were now put down at £15,250.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress has been made with Bills:

Bills brought from the Commons, read the first time, and referred to the Examiners: Bury Corporation Bill, Electric Lighting Provisional Orders (No. 1) Bill, Neath Corporation Water Bill, Gloucester Corporation Bill, Torquay Gas Bill, Wemyss, &c., Water Provisional Order Bill.

Bills read a second time: Electric Lighting Provisional Orders Bills (Nos. 3, 4, and 5), Gas Orders Confirmation Bills (Nos. 1 and 2), Water Orders Confirmation Bill.

Bills read a second time and committed: Carshalton and Croydon Gas Bill, Dundee Corporation Bill, Fulwood Local Board (Water) Bill, Southend Water Bill.

Bills reported, with amendments: Accrington Gas and Water Board Bill, Carshalton and Croydon Gas Bill, Paignton Gas Bill, Pontypridd Water (Tramroad) Bill.

Bill Royal Assented: Alloa Water Bill.

Petitions against the following Bills have been presented: Gas Orders Confirmation Bill (No. 1) in regard to the Ilford Order, from Charles Hibbert Binney; Neath Corporation Water Bill, from the Earl of Jersey.

HOUSE OF COMMONS.

Tuesday, May 29.

LONDON COUNTY COUNCIL (GENERAL POWERS) BILL.

On the consideration of this Bill, as amended,

Mr. J. STUART, on behalf of the County Council, said they had decided to accept the amendment put down by the honourable member for Bethnal Green (Mr. Howell), for omitting from the amended Bill the amended clause as to the lighting of staircases in industrial dwellings. The Council could not, however, accept the proposal standing in the name of the honourable member for Finsbury (Mr. Naoroji), to reinsert, in lieu thereof, the clause as it was originally proposed.

Mr. NAOROJI then moved the following new clause in substitution of the one already in the Bill: "The owner of any building designed for use in flats, or tenements, of which any staircase or passage is used in common by occupants for different flats or tenements, and is open at night, shall be bound to light every such staircase and passage, and to keep the same lighted from sunset to sunrise on every night, to the satisfaction of the lighting authority of the parish or district in which it is situate, who may, by an order under their seal, prescribe the amount of light and the position of any lights to be provided, and may serve notice of such order upon the owner of the premises. Any owner failing to comply with the provisions of this section shall be liable to a penalty of not exceeding £5 for every night in which he shall have so failed. Any lighting authority may, by agreement with the owner of any such building, undertake the provision and maintenance of the lamps and fittings, and the lighting and extinguishing of lamps, on such terms as may be agreed between them."

Mr. STUART, on the part of the London County Council, said they withdrew the clause as it originally stood in the Bill, and opposed the proposed new clause, because it meant the restoration, or nearly so, of the old one, and the Vestries of London had almost unanimously disapproved of that clause.

Mr. G. HOWELL also opposed the new clause; remarking that the original clause had been inserted on insufficient evidence. The proposed new clause would involve the imposition of a new rate; and, so far as he could learn, the Committee, though they might alter the incidence of a rate, had never been known to impose a rate.

Mr. BOULNOIS observed that, had not notice of the withdrawal of the original clause been given, he should have asked the Speaker's ruling as to whether it was not *ultra vires* on the part of the Committee to impose taxation without giving the slightest notice to the ratepayers upon whom the rate would be charged. The tenants of workmen's dwellings objected to the lighting of the staircases after eleven o'clock, for the reason that it attracted tramps and the houseless poor.

Sir J. GOLDSMID observed that he had been asked to state, on behalf of the oldest association for the establishment of workmen's dwellings throughout the Metropolis, that the proposal was not desired by the tenants, and would inflict a very great hardship on the society, by putting them to very large expense to light the staircases.

Mr. CODDINGTON wished, as Chairman of the Committee, to say that the clause, as it now stood in the Bill, had been inserted by the Committee on the understanding that the authorities would pay a proportion of the cost of lighting the staircases; and it was thought that both parties were satisfied with the arrangement. The new clause now proposed would be a great injustice to the proprietors of industrial dwellings.

Sir F. POWELL also opposed the proposed new clause.

Mr. J. ROWLANDS said the whole consensus of opinion, both of the County Council and the owners of these blocks, was to upset the decision of the Committee by striking out the clause with regard to lighting. He was conversant with the opinion of people living in the blocks; and they were utterly opposed to having the buildings left in darkness after eleven o'clock. At the same time, they could not put the cost upon the rates.

Mr. WHITMORE said the local authorities were the best judges of how this question should be dealt with; and it was only right that their view should be followed with regard to it.

The motion was then, by leave, withdrawn; and the Bill, as amended, was ordered to be read the third time.

NEWCASTLE AND GATESHEAD WATER BILL.

On the motion for the second reading of this Bill,

Mr. SETON-KARR moved that the Bill be read a second time that day six months. He said he opposed the measure in the interest of riparian owners, being trustee for one of them. In its present form, the Bill established a most dangerous precedent. It upset a right which had existed at common law for many years. The commercial

value of the estates in the neighbourhood affected depended upon the river; and, under the Bill, instead of a dam 15 feet high, which was authorized by the Newcastle and Gateshead Water-Works Act, 1889, a dam 77 feet high was proposed; and the Company were relieved from the obligation of making a fish-pass. The result would be to destroy the value of the water above the dam. There was no provision in the Bill for compensating riparian owners; and the crowning injustice of all was that it contained a clause taking from them their right of going to a Court of Law, and asking for compensation. He contended that a Parliamentary Committee was not the proper tribunal to assess money compensation.

Mr. T. HEALY raised a point of order. Was the honourable member, who was a trustee for one of the owners, and who had appeared before the Lords Committee as a petitioner against the Bill, entitled to move the House in a matter which thus concerned him?

The SPEAKER: No matter how closely an honourable member may be interested in a Bill, he may try to persuade the House to take his view of the case. Whether or not he can vote is another matter.

Lord R. CHURCHILL: Even if he receives no pay, and holds a purely honorary office?

The SPEAKER: It is quite competent for him to move the rejection of a Bill, however closely he may be interested in it.

Mr. SETON-KARR said he was perhaps an interested party, so far as his trusteeship went. All the riparian owners asked was that the Bill might pass in such a form that, if hereafter they were damnified, they might go to a Court of Law. He hoped the House would hesitate before it took away a legal right that had existed for fifty years.

The CHANCELLOR of the EXCHEQUER protested, in the interests of the time of the House, against the proceeding of the honourable member, who, he said, represented certain private interests which had been fully heard in the House of Lords.

Mr. SETON-KARR said he did not admit that those interests had been fully heard.

The CHANCELLOR of the EXCHEQUER pointed out that in the Lords' Committee the Bill was under consideration for six days. What, he should like to know, would be the progress of business in the House of Commons if every individual petitioner against a Bill, who might think that his case had not been heard sufficiently during a six days' inquiry in the other House, were to be at liberty to raise a debate in the House of Commons, with a view to the rejection of the Bill on the second reading? Upon what kind of allegation did the honourable member proceed? He apparently alleged that the House of Lords, of all bodies in the world, had been disregardful of private interests and private property. That was the kind of allegation upon which they were asked to waste the time of the House. It had been ruled by the Speaker that the honourable member was entitled to move his amendment. But the House was entitled to dispose of it immediately; and he trusted that no further time would be devoted to it.

Mr. J. A. PEASE said that the supply of water which would be provided if the Bill passed was urgently required by the inhabitants of Newcastle and Gateshead. Last year, during six months, the consumption of water had to be reduced in the locality by one-half; and every householder had his supply cut off at six o'clock each evening. The powers acquired by the Company in 1889 were insufficient. For about forty years they had paid, on an average, no more than 5 per cent. dividend; and they charged the exceptionally low price of 4½d. per 1000 gallons. All the objections that could be raised against the Bill had been heard by the Lords' Committee.

Mr. SETON-KARR offered to withdraw his amendment; but leave was refused.

When the motion for the second reading was put, the honourable member at first challenged a division. But he afterwards withdrew his opposition; and the Bill was read a second time without a division.

The following progress has been made with Bills:—

Bills read a second time and committed: Aberdare Local Board Water Bill, Abertillery Local Board (Gas and Water) Bill, Edinburgh and Leith Corporations Gas Bill, Falkirk Corporation Gas Bill, Millom Local Board Bill, Newcastle and Gateshead Water Bill, Swinton Local Board Bill.

Bills reported: Hebden Bridge Gas Bill, Plymouth and Stonehouse Gas Bill, Wemyss, &c., Water Provisional Order Bill.

Bills read the third time and passed: Electric Lighting Provisional Orders (No. 1) Bill, Gloucester Corporation Bill, Wemyss, &c., Water Provisional Order Bill.

HOUSE OF COMMONS COMMITTEE.

(*Before Sir* JAMES KITSON, *Chairman; Sir* J. DICKSON-POYNDER, *Mr.* L. HARDY, *Mr.* BURNIE, *and Mr.* BONHAM-CARTER, *Referee.*)

Monday, May 28.

PLYMOUTH AND STONEHOUSE GAS BILL.

At the sitting of the Committee to-day, the promoters brought up clauses carrying out the decision announced at the last meeting (see *ante*, p. 915); and the Bill, as amended, was ordered to be reported.

PRESTON GAS BILL.

This Bill was promoted by the Preston Gas Company to obtain power to carry out an extension of their works, make arrangements for supplying the electric light, and increase their capital.

Mr. BIDDER, Q.C., Mr. PEMBROKE STEPHENS, Q.C., and Mr. ROWLAND WHITEHEAD appeared for the Company; the opponents—the Corporation of Preston and Mr. Montague Joseph Feilden—being represented by Mr. CRIPPS, Q.C., Mr. WORSLEY TAYLOR, Q.C., Mr. MOON, and Mr. C. A. RUSSELL.

Mr. BIDDER, in opening the case for the promoters, said the Preston Gas Company was certainly the oldest provincial gas company; having been formed as a Limited Company in 1815. As the consumption of gas grew, the works had been extended. The maximum consumption of gas was reached in 1891; for in 1892 and 1893 there was a temporary reduction, owing partly to depression in trade, partly to electric lighting, and partly to the fact that the Company were compelled, for the first time in their history, to make a small increase in the price. This temporary shrinkage was, however, now being recovered; and the Company would shortly find it necessary to provide additional manufacturing plant, and to expend considerable capital for the purpose. It was impossible to increase the manufacturing power at the existing works; and the Company had therefore gone outside the town to select a site of 25 acres, which was conveniently situated for the purpose of gas making. The capital powers of the Company were practically exhausted; and the reserve fund had been drawn upon, with the exception of £260. The maximum price the Company were authorized to charge was 4s. 2d. per 1000 cubic feet, with certain discounts, which reduced it to 3s. 9d. to the small, 3s. 6½d. to the medium, and 3s. 4d. to the large consumers. In 1885, the price had been reduced to as low as 2s. 7d. to the large consumers; but the depression of trade and the increased charges for coal compelled them to raise it to an amount which represented 2s. 11d. to the large consumers and the others in proportion. Of course, the consumers did not like this; and they and the Corporation memorialized the Company on the matter. But the facts were too strong; and they were compelled to maintain the price, though even this was considerably within the maximum. With the growth and development of the district, he hoped they would be able to get back to, if not below, the lowest figure they had previously charged. There was no change suggested in the illuminating power, which stood at 18 candles; but the Bill proposed an alteration in the testing-burner—substituting a Sugg's Argand for the batswing or fishtail burner. It was alleged that the Company obtained an advantage by this substitution; but he denied that this was so. Dealing with the petitions against the Bill, he said that Colonel Feilden's opposition was that of an adjoining landowner, and that the promoters were perfectly willing to agree that, if they touched a single inch of his property, they should be bound to take the whole. As to the opposition of the Corporation, he did not know what made them so pugnacious on the present occasion, for their relations with the Company had hitherto been very satisfactory. They objected to the Bill as injuriously affecting them as Conservators of the Ribble, and also their dock undertaking, by the erection of a jetty in the river for landing coal. But the promoters were willing to meet them, so as to prevent any possible interference with the access to the dock, or with the timber pond, by the construction of the proposed line of rails to the works. The Corporation also took exception to the proposed site, to the raising of additional capital, and to the power of the Company to demand payment for gas in advance; urging that, if this power were granted, 5 per cent. interest should be allowed upon such prepayments, instead of the 4 per cent. at present paid.

The CHAIRMAN inquired if that was a common power.

Mr. BIDDER said it was a recent clause; but he should show that it had been put into other Gas Bills. The Corporation asked that further provision should be made with respect to the purity of the gas supplied by the Company; but he did not think the Corporation had ever seriously complained of the lack of purity. They also objected to the electric lighting powers contained in the Bill; but, as the Company which was licensed to supply electricity in the town did not oppose, he did not think it very much concerned the Corporation.

The following evidence was then given:—

Mr. *Henry Green*, the Engineer and Manager of the Gas Company, examined by Mr. PEMBROKE STEPHENS, said the existing works were designed and carried out under his superintendence. He described the legislative and financial history of the Company; and he said that, when they found it necessary to increase the price of gas, a public indignation meeting was held, and that by one of the resolutions passed on the occasion the people pledged themselves to discontinue the use of gas. The result was that a considerable number of meters were disconnected in a few weeks. The obligation to supply 18-candle gas necessitated the use of a large quantity of cannel, which was now getting very scarce in the Wigan district. During the last few years, they had had great difficulty in purchasing it, except at very high rates; and the consequence was they had had to go to Scotland for a good deal of cannel, in order to improve the illuminating power of their gas. The Company had at present three manufacturing stations. But all the works were built quite close up to their limits; and it was the absolute duty of the Company to go elsewhere for a site to carry out extensions to meet the present growing demand. Taking into consideration the facilities of getting coal from the river, the Directors felt that there was no site equal to the one which had been selected; and it was so out of the reach of any property that could be injuriously affected, that they did not consider at the time that any objection could be taken to it. There was also railway communication into the works. Detailing the difficulties in connection with the coal supply, witness stated that the Company had been endeavouring to negotiate contracts; but the mine-owners would not enter into them with the Company unless they inserted a clause terminating them when the (Mines Eight Hours) Bill became law. They used to be troubled with a strike clause; but now they were troubled with an eight-hour clause. Referring to the question of the illuminating power of the gas, he said that there were two Companies or Corporations whose gas was as high as 20 candles; nine at 18 candles; and about 500 in which it was below this. There was no reason for suggesting that the Directors had any interest in spending more capital than was necessary for the proper working of the Company.

Cross-examined by Mr. WORSLEY TAYLOR, witness stated that under the Bill they were proposing to raise a quarter of a million more money. He was not aware that two new cannel mines had just been discovered in the Wigan district. Notwithstanding the difficulties experienced in maintaining the illuminating power of the gas, they did not propose to reduce it, though the new burner might affect this question. He did not think the effect of the new test would be that they would produce gas of 2 candles less power; but even if this were so, the public would get the advantage in the Company being able to make it at a cheaper rate. Such a reduction in the candle power would mean 4d. per 1000 cubic feet less in the cost of manufacture. This, however, would not be entirely to the advantage of the Company,

because as soon as they could pay the statutory dividend, the price would be reduced to the consumer. They did not intend to lower the illuminating power. The only reason for changing the burner was that Sugg's Argand was a more reliable one than the ordinary batswing. When the extensions were carried out, they proposed to go into the new districts specified, where there would be a large consumption. The consumers in the old districts would not have to bear the brunt of the extensions, because if it did not pay to make them they would not do so. The ordinary average capital expenditure per million cubic feet of gas sold was £500, which for the 55 millions increase would give £27,500, against the expenditure of £87,000 by the Company. The explanation of this was that in 1885 there was every prospect of the Company going on as prosperously as they could do. In 1877, every retort was at work; and they had not a single one to spare for any contingency whatever. It then fell upon the Directors to meet the demand; and they thought by extending the works they might tide off coming to Parliament for several years. These works cost about £74,000; and in 1891 only half of them were occupied, the remaining half being unproductive. This was the reason why the capital between 1885 and 1891 was excessive. The existing retort power of the Company was about 3,645,000 cubic feet; and the present daily make of gas was something like 2,645,000 cubic feet. The storeage capacity was 3,300,000 cubic feet; and it could be increased by improving the gasholders. Adding an extra lift would allow for another million cubic feet in the two holders.

Mr. WORSLEY TAYLOR: So that at the present time, with the existing retorts, you have a surplus manufacturing power of a million, and a surplus of something less than a million of storeage capacity, and facilities for increasing it by another million, without what I may call new works occupying new ground?

Witness said that was so. The present land in the possession of the Company was from 13 to 14 acres in extent; and he thought they would be very tightly pressed if they were limited to 2 acres per million cubic feet. The only land which they had unused at the present time was a piece at Ribbleton Lane, which was intended for storeage room. They had also some land at Farrington; but this was six miles away. Sooner or later, they might have to move their old works; but they certainly would not shift their Water Street works, upon which they had spent £74,000 since 1887. Questioned with regard to the number of electric light lamps in Preston, witness said he did not know that there were 10,000; nor did he know anything about the electric light except as to the manner in which it had affected the Company. Some 230 of the gas consumers had adopted the light, partially or exclusively. These consumers burned 31,655,000 cubic feet of gas previously to the adoption of the light; now they burned 21,145,000 cubic feet—making a loss to the Company of about 10,500,000 feet. He did not think the increase in electric lighting would go on, as they had the cream of the place now, and there was much dissatisfaction on the part of a number of the consumers. The great majority of the Gas Company's customers would be small consumers, who would be charged the maximum price of 3s. 9d.

Mr. WORSLEY TAYLOR was proceeding to cross-examine the witness as to the expenditure before 1879, when the Company's last Act was obtained, when

Mr. PEMBROKE STEPHENS objected.

Mr. WORSLEY TAYLOR: I want to see whether you have expended your capital judiciously. We have to pay on everything, whether judicious or injudicious expenditure.

The CHAIRMAN: Suppose you establish that they were unwise in their expenditure in the past, the Committee have to deal with it at present having regard to the future requirements of the district. I do not see what it has to do with the matter.

Mr. WORSLEY TAYLOR: From their past conduct we shall ask you to infer what they will do in the future if you send them away from the control of Parliament with £250,000 in their pockets and these maximum prices.

The CHAIRMAN: I do not think you will assist the Committee by following this line of cross-examination further. We have to deal with the proposed new works; and the reason why the Company required additional capital in the past is a matter which does not assist us.

In further cross-examination, witness stated that he thought on new works, without gasholders or anything of that sort, they would spend from £115,000 to £120,000; but they did not contemplate spending this for probably four or five years. They could not look to the reduced consumption that had taken place during the last two years as a permanency, for they hoped the town would be more prosperous than at present. The gasholders would cost £30,000; the railways and sidings were estimated to cost £13,565; and incidentals, such as fencing and chemical works, would come to £15,000, as they would probably put up tar or sulphate of ammonia plant upon the site, in order to work up the residuals. New mains would cost £14,000; and this would bring the total up to £200,000. At the present time the cartage from the railway cost about 10d. per ton. Some time ago, the Company commenced the erection of a new gasholder at Walton. They had a holder there before—a smaller one than that which they were fitting up now—and a serious accident occurred to it, so that they had to take it down. They at once started to erect a rather larger one; but, in consequence of the reduced consumption of gas, and the anxiety of the Directors not to expend unnecessary capital, they stopped their operations until things were somewhat better. When they stopped the work, they had nearly finished the tank. The holder was to have been 100 feet in diameter; and the capacity would have been nearly 500,000 cubic feet. He did not think the new works would cause any nuisance to the surrounding neighbourhood, although there had been some agitation about the matter. There had never been any complaints with regard to the existing works. It was not proposed to use the jetty for anything but landing coals for the new site. They did not intend to take coals from it to the existing works.

Cross-examined by Mr. RUSSELL with regard to possible injury to Colonel Feilden's estate, witness said the traffic from the jetty to the works would not obstruct the view; and he did not think any damage would be done to the property.

In re-examination by Mr. PEMBROKE STEPHENS, witness stated that Colonel Feilden had a dock of 40 acres, and the traffic connected with it, in proximity to his property; and he did not think the carriage of 40,000 tons of coal would be any considerable addition to that traffic. The agitation against the Company had spent its force; and the tide was now returning. With the new dock, no doubt the trade of Preston would improve; and there naturally would be an increased demand for gas. Assuming a 4 per cent. increase, the safe acting capacity of the present works would be reached in three years. The reason the Company came to Parliament now was simply because the capital was getting exhausted; and it would have been folly to apply for a further amount, and then in three or four years' time to come again for a site. He considered the capital had been judiciously expended in the past. The Company had every retort in use before they spent a halfpenny of capital on the new works; and they could not have gone on another winter without making the alterations and spending the money they did. As to the quality of the gas, it was too high for gas-engines; and this to a certain extent checked its consumption for fuel and manufacturing purposes.

The CHAIRMAN asked if the proposed burner was a standard burner.

Witness said the Company were not applying for a standard burner. When they originally came to Parliament for their 1865 Act, there were some negotiations between them and the Corporation as to the quality of the gas; and it had ultimately ended in the Company putting up the quality to 18 candles. At that time, the burner considered best for testing purposes was a batswing. But since then a great improvement had taken place; and it was found that that burner was not suitable for 18-candle gas. To the best of his knowledge, there had not been any complaints from the Corporation for many years.

Tuesday, May 29.

On the resumption of the proceedings to-day,

Mr. *E. Garlick*, a former Mayor of Preston, was called on behalf of the promoters. He said the site proposed in the Bill possessed great advantages, on account of its proximity to the River Ribble, and the facilities for railway communication. At present the Company had to cart 50,000 tons of coal and other materials through the streets of Preston; and this would be obviated by the construction of the proposed works. The Corporation and the ratepayers would therefore benefit by the scheme. As to the opposition of Colonel Feilden, the nearest point of the proposed works to his house was 212 yards distant. Other owners had land within 17 and 25 yards of the house, upon which manufacturing works could be erected, which would interfere to a much greater extent with the value of the property. The new railway would only be 30 yards from the house. The limits of deviation in the Bill, to which the Corporation objected, were, in his opinion, exceedingly small. The new works would not interfere with the Corporation's docks, or with their proposed timber pond. Only 4½ acres of the dock estate was to be taken for the road and line of rails; and this was a very small matter when the size of the estate was considered. It was true, as the Corporation had suggested, that the jetty from the works would extend into the river 90 feet beyond high-water line; but it did not project far enough to interfere with navigation. Vessels did not sail over the wall, but kept in the deep water. Even a vessel discharging at the jetty would not interfere with the direct route up the river to the docks. The Ribble had a bottom width, excluding the slope, upon which vessels did not sail, and which was the only part interfered with, of 180 feet. The Surrey Canal had only 72 feet; and the Manchester Ship Canal, 120 feet. He held that the jetty would be quite safe, even in times of flood; and he could not see how it would interfere with the storm sewage outlet.

Cross-examined by Mr. CRIPPS, witness admitted that the present works would continue to exist for the time being—though eventually they would disappear. He estimated the saving in ten years, through the erection of the new works, at £1000, or £100 a year.

Mr. CRIPPS: What cost do you propose to incur to save this £100?

Witness: I meant that it would save the Corporation £100 a year.

But what will be the saving to the Company?—I have not gone into that point.

How far is your road from the north side of the timber pond?—About 75 feet.

If you take the 15 yards deviation, it will only be 15 feet?—Yes.

Will the timber pond be of any use with its quay space thus taken away?—There will be plenty of space. If there is not room to deal with timber on the north side, it could be floated to the south side. But the north side embankment would be sufficient for timber.

The CHAIRMAN remarked that the Company's map was misleading, as it did not show the pond.

Mr. PEMBROKE STEPHENS: There is no pond yet—only a diverted river bed.

In further cross-examination, witness said there was not anything novel in running powers being granted over a private line of rails. As to the jetty, he denied that it would interfere with the fairway of the Ribble. He admitted that, at a neap tide, vessels could only pass this point during 40 minutes each way. Asked if a vessel were warping to or from the jetty, what would have to be done during this time, he replied that it would not take up more than 120 out of the 220 feet of fairway This would leave room for the traffic to pass on the other side. He knew that great expense had been incurred in dredging to make the fairway; and also that the docks had cost a million of money. But, in his opinion, the jetty would not interfere with the fairway.

Re-examined by Mr. PEMBROKE STEPHENS, witness said the views from Colonel Feilden's house might be destroyed at any moment, if neighbouring owners chose to build. As to the fairway of the river opposite the jetty, vessels returning unloaded need not select the exact time of high tide for passing; and no block was likely to arise at the point. The quantity of land held in connection with the docks was in excess of that likely to be needed. The small portion sought by the Company was for the purpose of securing facilities for the public lighting of Preston; and they were prepared to meet the Corporation in every reasonable way in laying out the proposed road and railway.

In reply to the CHAIRMAN, witness said that, when the river bed had been further deepened, larger vessels would go up to the docks. The cost of the docks had been something like a million sterling. The height of the embankment of the timber pond was about 6 feet.

In reply to Mr. BONHAM-CARTER, witness said that, in the event of works being undertaken by the Corporation, lower down the river, the Company might be able to allow them running powers over their line in return for those now sought.

Mr. *A. Giles*, President of the Institution of Civil Engineers, said he was of opinion that the road and railway proposed were necessary to the new works; and there was no reason why they should prejudice the working of the docks. He considered, however, that clause 15 in the Bill, which would give the Company power over the sidings in the dock premises, went too far, and was not necessary. A modification of the clause might be made which would be fair to both parties. The Company might reasonably expect to have to deal yearly with 75,000 tons of coals and residuals at this point; and if the access by rail was not granted, the traffic by the river would be increased. He was not surprised that the dock authorities should object to a jetty projecting into the river as shown on the plan. It would, to a certain extent, be an obstruction at high water; but a slight modification of the plan, within the limits of deviation, would prevent any interference with the traffic. The light-vessels which would be used at the jetty could be swung in or out long before the tide was high enough for the larger vessels from the docks, which were the only ones limited to time, to pass the point.

Cross-examined by Mr. MOON, witness said he saw no objection to the taking of property from the dock land, and the laying down of lines by the Company. All he objected to in the clause was the provision that the Company should have powers over the docks, lines, and sidings. He suggested that the jetty should be set back 30 feet, which would still admit vessels of 8 to 10 feet draught. Those at present bringing cannel were very light draught. They would have to be tugged to the jetty, or go with the tide. They would be very unlikely to swing into the fairway from the jetty when a large vessel was in sight and bearing down on the spot. The jetty would be used for all coal coming by water.

Re-examined by Mr. WHITEHEAD: Vessels using the waterway would be subject to the bye-laws of the Harbour Board. Ocean steamers with more than 14 feet draught could not at present enter the docks; and the river would have to be deepened to 20 feet if the trade of the docks was to increase as it should do. As the Gas Company supplied a public want, the Corporation were interested in giving proper facilities for the conveyance of coal to the new works.

By the CHAIRMAN: He had not read the Board of Trade report on the jetty, and could not see how the navigable width could be said to be reduced by 50 feet. The high-water surface width might be reduced to this extent.

Mr. WHITEHEAD: That is not a statement by the Board of Trade, but is quoted as a representation made to them by the Corporation.

Mr. *J. Hibbert*, an architect of Preston, said he considered the proposed site a most convenient and suitable one for the new works. They would not be in any sense a nuisance at that point. Colonel Feilden's house, which it was said would be affected, was badly constructed, more or less dilapidated, and approached by a very bad road. The Company's present works, in the heart of the town, were not found to be a nuisance.

By Mr. WORSLEY TAYLOR: He did not deny that the interest of the Corporation was to protect consumers from undue expenditure by the Company, which might recoil upon them. But he did not think the Company desired extravagant expenditure.

By Mr. RUSSELL: He was not aware that Colonel Feilden had put his house in thorough repair, with the view of spending the rest of his life there. He admitted that the works would affect the amenities of the residence.

Re-examined: It was probable that manufacturing premises and industrial dwellings would soon spring up round the spot.

Mr. *Corbet Woodall*, M.Inst.C.E., said the business of the Preston Gas Company had been a progressive one until the last two years, when a rise in price had stopped the increase. It was probable that there would be a rapid growth shortly; and the necessity would then arise for an extension of the works. The present works were in capital repair; but it was undesirable to run them up to their full power, without a margin for contingencies. Allowing a 5 per cent. annual increase of business, the existing works would meet the wants of the town for about three years. This was allowing a margin of 15 per cent. for renewals of retorts, and other contingencies. This margin was not too high. Last year, owing to the coal strike, the Company were compelled to buy coal with which they were not familiar; and the result was the reduction of the production from 9900 to less than 9000 cubic feet per ton of coal carbonized. If new works were required, they should be undertaken fully three years before they were actually needed. The situation of the works was very suitable, especially on account of the facility of rail and river communication. He considered that the Corporation ought to be glad to get the works away from the town, and to reduce the carting in the streets. He admitted that a large amount of capital had been invested in the gas-works at Preston in comparison with other towns having a similar production. Meters stood at £50,000 to £55,000, or 30 per cent. more than in other towns of the same size. Mains had also been very costly, on account of the nature of the demand. This was so heavy during the hour and a half that the mills were lighted, that the mains had to be double the size that would be required in a place where the consumption was spread over a longer time. Comparing the capital expended since the last application to Parliament, it amounted to £862 per million cubic feet of production; but as the Company possessed surplus works created with part of that money, the cost might be put at £650 per million. They had supplied 18-candle gas at 2s. 9d. per 1000 cubic feet—a record of which they had no reason to be ashamed, though the price had had to be increased. In London, 3s. 1d. was paid for 16-candle gas. In London, too, there was a production of 10 million cubic feet per mile of main, against only 3½ millions in Preston. Coal was cheaper in London than in Preston. The capital to be raised under the Bill was £200,000, with £50,000 of debenture stock; and he did not think this excessive. With a 5 per cent. per annum increase, they would double the consumption in 14 years. It would take fully a quarter of a million sterling to construct the works necessary for this demand. The Company's interest was to keep down the capital. He contended that, if electric lighting was to be introduced in Preston, it could be done most economically and successfully by the Gas Company. He was in favour of the Company's proposal to substitute the Argand for the batswing as the test burner.

By Mr. WORSLEY TAYLOR: It was quite possible to produce a million cubic feet of gas per annum on an area of two acres. The total present productive capacity of the Company's works was 3,750,000 cubic feet, including the additional retorts shortly to be constructed at Moor Lane. His reason for calculating for a 5 per cent. increase was that for ten years the augmentation had averaged 4½ per cent. He admitted that in the last six years the percentage of increase was lower; but taking a longer period than ten years, it was greater. He anticipated that the reduction of the consumption following the increase in price would soon be succeeded by a recovery. Taking the capital expenditure of the Company from 1882 to 1893 at £127,600, and the outlay on mains at £15,000, he could not give an opinion as to whether the proportion was a fair one. The total capital of the Company was £1000 per million cubic feet of gas sold; but he had shown that the surplus works reduced this to £650. As to the proposal that the Company should apply for electric lighting powers, he took it that they would proceed by acquiring the existing electric lighting undertaking, if they took action at all. There was no clause in the Bill bearing upon the purity of the gas. He considered the money spent in getting rid of a few grains of sulphur was frequently wasted; he thought the existing protection was sufficient. He approved of the sliding-scale, and would not object to see it incorporated in the Bill. Where a Company had a large capital in proportion to their sales, he considered that the initial price for the sliding-scale should be the same, and not lowered on that account, which would be unfairly penalizing the shareholders who had taken up shares on the faith of the guarantees given by the scale. In other towns, such as Radcliffe, Yarmouth, and Wigan, there was a greater capital per million cubic feet of gas than in Preston.

Wednesday, May 30.

Mr. *George Livesey* in answer to Mr. BIDDER, said he had inspected the works of the Company, and had visited the site of the proposed new works. The existing works were in very good order, and well arranged. He did not consider that there was any evidence that the Company had been extravagant in its expenditure, although the capital was rather high. The necessity for lighting the mills of the town would call for a large capital expenditure; and, of course, the rebuilding of the Moor Lane works would involve a loss of capital—rebuilding always did. It was a great misfortune that the Company did not go outside the town in 1879; and the longer they delayed getting new works outside the town, the worse it would be. Had they gone outside earlier, the Moor Lane works would not have had to be rebuilt. He did not think a more suitable site for the new works could be found than that proposed. There had been a moderate increase in the consumption in the past; and he thought that it would be maintained—especially taking into consideration the probability of the development of trade in connection with the new docks. The Company's existing capital was practically exhausted. The proposed additional capital of £200,000 and further borrowing powers of £50,000 was in accordance with precedent; and he thought it was rather more than might be necessary, looking at the probable increase in the consumption. The Company could not fairly be asked to take anything less than £200,000; but he thought they might have £80,000 of debenture stock, and £150,000 of ordinary capital, with an obligation to raise the first £30,000 by debentures, so that the debenture stock should be one-third of the ordinary capital. He thought the sliding-scale arrangement worked well, and would always recommend it; but the initial price must not be too low. As shown in the case of the West Ham Gas Company, if the initial price were fixed too low, that affected the price at which the Company could obtain money; and the result was that it worked against the consumers. He thought that 3s. 4d. should be the initial price in this case. The batswing was an unreliable burner; it did not give anything like such regular and certain results as the Argand. He had not made any experiments with the batswing used in Preston; but his impression would be that the substitution of a suitable Argand would have the effect of making the gas appear to be of a somewhat higher quality.

Mr. BIDDER: With a proper Argand burner, as specified in the Bill, the public would be secured the 18-candle gas which Parliament intended to give them?

Witness said that, if his supposition were correct, the public were getting more than 18-candle gas with the batswing. The batswing was not a fair measure of what Parliament said they should have.

Cross-examined by Mr. CRIPPS, witness said he was the author of the sliding-scale, coupled with a standard price. It had had this effect in London, that whereas every four or five years previous to its adoption there had been an agitation, ever since its adoption there had been peace. The important point was to arrive at a fair standard or initial price. In suggesting 3s. 4d. for this Company, he had desired to name a figure which would enable the Company, under ordinary circumstances, to pay their existing maximum dividend. Under "ordinary circumstances," he meant to include such exceptional circumstances as Companies were now-a-days liable to in this age of Unions and strikes. He had fixed the 3s. 4d. upon 1893. If he had taken 1891, that would have given a lower figure; but having regard to the experience of 1892 and 1893, he thought a higher initial price than the 1891 figures would give was necessary to tide over exceptional years.

Mr. BIDDER: 1891 was our most prosperous year.

In further reply to Mr. CRIPPS, witness said that the use of the Argand burner would probably enable the Company to send out gas of a slightly lower illuminating power; and this would be a distinct advantage to the consumers. He expected the Company would very soon recover the loss of last year, which was due in a very large measure to the exceptionally fine weather. Gas companies all over England had the same experience. The Companies in London, for instance, lost 4 or 5 per cent. in consequence of the fine weather. With the return of normal weather, that loss would be rapidly regained. Taking all matters into consideration, they might be three

or four years recovering the loss. In regard to the standard price, it must be remembered that this was not the selling price; it was really the regulator of the dividend—nothing more. The advantage of a good standard price was that it offered the Company a certain inducement to reduce their price, in order to get an increased dividend.

Re-examined by Mr. BIDDER: In fixing an initial price, it was not reasonable and fair—and it would be detrimental to the consumers—to take the Company's most prosperous year. In London, in 1869, there was an Argand burner used for testing the gas; but it was found that it did not do justice to the gas. A new burner was therefore introduced, which increased its apparent value from 14 to 16 candles; and the Companies were permitted by Parliament to use that burner. The old burner depreciated the quality of the gas, as it was not a fair measure; and a new burner was substituted without any reduction in the price.

By the CHAIRMAN: It had been the custom to use the batswing for the higher quality of gas, and the Argand for the lower quality.

By Mr. BONHAM-CARTER: He was aware that it was generally the practice of Parliament to limit the debenture stock to one-fourth of the ordinary capital; but that proportion was not of universal application. The South Metropolitan were allowed to raise one-third; and that was done with the consent of the Metropolitan Board of Works, on the grounds that the security the Company offered was sufficient to warrant the raising of that greater amount of debentures, and that the larger the amount raised by debentures, the cheaper the general capital became. It had worked well with the South Metropolitan Company; and it was adopted last year in the case of the Crystal Palace Company. He saw no reason why it should not be repeated here. The batswing was used in Scotland, where they had gas of over 20-candle power, because the Argand was not a good test for gas of such a high quality. There was more carbon in the higher quality gas; and the difficulty was to burn it effectively.

Mr. BIDDER: In point of fact, beyond a certain degree, increased illuminating power is a doubtful bargain?

Witness: It is a decided disadvantage; and I have a very high authority for that opinion.

Mr. *Corbet Woodall*, recalled and re-examined by Mr. BIDDER, said that, in regard to the initial price under the sliding-scale, he thought, according to what had been the practice of Parliamentary Committees, that 3s. 5d. would be a fair initial price. The actual price last year was 3s. 4d. and a decimal—practically 3s. 5d.; but he had not taken that year. He had taken the price for 1891 and 1892, which was 3s. 1d.; and he thought it would not be unfair to allow 4d. beyond that as a margin for such contingencies as strikes, &c. On the other hand, he would not object to a neutral zone of 3s. 2d. to 3s. 6d. being adopted. The consumption per consumer in Preston was the lowest he could find anywhere; and the consumption per lamp was absurdly low. He thought Preston was the worst lighted town in the country; the consumption there per public lamp being 7300 feet, while the average for corporations was 16,000 feet, nad for companies 19,000 feet. The mills in the town rendered necessary very large and expensive meters. The amount of capital invested in the meters was, consequently, over £50,000, which was abnormally high. In regard to the charge to consumers per candle power, Preston was well below the average of several large towns.

Professor *Vivian B. Lewes* said that he had been to Preston and examined the gas supplied to the town. He found it to be of a very fair quality. It contained 19 grains of sulphur, in the form of sulphuretted hydrogen, and 0·3 of a grain of ammonia per 100 feet; so that, as regards purity, it was very satisfactory. The stipulated illuminating power at Preston was 18 candles, which was exceptionally high. The burner prescribed under the existing Act was the batswing; and he considered that the consumers would be distinct gainers on the whole by the adoption of an Argand burner in place of a flat-flame burner. When gas was consumed by a flat-flame burner, one of the great drawbacks was that the flame was not rigid, and was exposed to being bent on one side by the slightest possible breath of air. The result was that one never obtained a flat sheet of flame from the batswing burner; the corners being always turned to or from the disc of the photometer. This meant considerable fluctuations in the readings; and hence the readings of such burners could never be absolutely relied upon, and their use for measuring gas meant the adoption of a haphazard method. The flat-flame burner had been used for measuring rich gases, simply because there had been no Argand burner which would supply the proper amount of air. Each quality of gas required a different quantity of air, in order to be properly burnt, and to fully develop its illuminating power. The only standard Argand burner was the No. 1 Sugg, which was designed to consume 16-candle gas. Such a burner would not do justice to 18-candle gas, but would give it a lower illuminating power than would a flat-flame burner. There was a second burner now made—Sugg's "F" burner—by which, by the slightest alteration in the way in which the draught was brought to the flame, they were able to get a more thorough supply of air to the flame, and therefore a better consumption of the gas. Comparing this new Argand burner with the flat-flame burner at present employed at Preston, with gas burning at the rate of 5 cubic feet per hour, on the whole (taking averages) that burner would not give over half a candle more light. In the experiments he made at Preston, the "F" Argand only gave 0·2 of a candle more light than could be obtained by the use of the Preston flat-flame burner. In a further series of experiments which he made in London—of course, with gas of a slightly different character, but still an 18-candle gas—he made the difference between the two burners to be little more than half a candle. The advantage of the substitution of this Argand for the batswing did not consist in getting a higher illuminating power, but in obtaining more reliable and regular results. He had been over the Preston works, and was exceptionally pleased with them. There was an amount of scientific method shown by the Manager in the arrangement of the works, and the way in which they were constructed—especially at Moor Lane—which was very rarely found.

Cross-examined by Mr. CRIPPS, witness said he made seven or eight experiments in Preston, and twenty to thirty in London. It was quite possible that a large number of experiments might have been made which showed a difference between the burners of 1½-candle power. These results entirely depended on the minutiæ of the details. In his experiments, he had used the flat-flame burner employed in Preston, with the rate of flow of gas at present used there. In the London experiments, he had used water gas; and therefore those tests were not reliable. He therefore relied upon the Preston experiments. The greatest difference in the London experiments was 0·7 candle.

By Mr. BIDDER: He was quite satisfied that the Preston tests were normal and reliable tests.

Mr. *W. T. Sugg*, in reply to Mr. WHITEHEAD, said that the Argand burner proposed to be adopted was a consumer's burner, and was known as No. 8. There was no standard Argand at present for 18-candle gas.

The CHAIRMAN: I think we are quite satisfied that the Argand is better than the batswing. What we want to know is what is the recommendation of your own Argand burner, as against the others.

Witness said he had been asked to provide a burner which would show, taking an average number of tests, no difference in the quality of the gas as between the two burners; and this lamp complied with that condition.

Cross-examined by Mr. MOON, witness said he knew that small consumers were numerous in Preston, and that such people used flat-flame burners; but he did not think Parliament had them in view when fixing the flat-flame burner as the standard. If his burner showed that the gas was of 18-candle power, it would be certain that the consumer would get gas of that value.

By Mr. BONHAM-CARTER: He had made his experiments with an 8-inch chimney; and the clause in the Bill ought to be altered accordingly from a 7-inch to an 8-inch chimney. In drafting, there had been some confusion between the "London" Argand and the new burner.

Mr. BIDDER said they were guided by Mr. Sugg in this respect; and it was arranged that the clause should be amended.

At the close of the promoter's case, the room was cleared. On the Counsel and parties being called in,

The CHAIRMAN said: The Committee are of opinion that the promoters have not proved their case for the compulsory powers in the Bill, either for making the railway over the dock property of the Corporation, or for the running powers over their dock lines. This decision does not apply to the jetty, nor to the new roads; but the Committee would require that the jetty should be shortened and recessed as suggested by one of the Engineers.

Mr. CRIPPS, in opening the case for the Corporation, said they had spent a million and a quarter on the dock and the access to the sea; and they protested against any interference with their rights. He asked that the new site, the viaduct or pier and jetty, and the access thereto along the north part of the dock property, should be struck out of the Bill. No case had been shown for this; and the Company were contemplating an extravagant expenditure. What would be the value of the jetty, if recessed? No large vessel could then come to it. The Company had practically 30 to 40 per cent. of unused space at the present day; and it could not therefore be suggested that there was any immediate necessity for any large outlay on new works. He was not going to object to the proposed new burner; but he should ask that, in dealing with the price of the gas to the consumer, any difference to the advantage of the Company should be taken into account. There could be no question but that the sliding principle ought to be adopted; but its value depended on the initial price. He suggested that this should be 2s. 9d. or 2s. 10d.; and he should ask the Committee to reject the Bill, unless a fair arrangement was made as regarded the initial price. No case had been made out for the additional capital; but the Corporation were willing that some further capital should be given, if there was a fair sliding-scale arrangement.

The CHAIRMAN: The Committee are of opinion that the proposed site is a very good one for the works. Why cannot you enter into some voluntary arrangement to work the traffic both by rail and water?

Mr. CRIPPS: Any suggestion of that kind which is made to us by the Company, we should consider most carefully; but we cannot enter into any arrangement which would interfere with our fairway.

Thursday, May 31.

To-day the Committee proceeded with the consideration of the Bill.

Sir *F. J. Bramwell*, F.R.S., examined by Mr. WORSLEY TAYLOR, said he had been consulted by the Corporation of Preston, and had made himself acquainted with the facts of the case. In his opinion the prospect of a large consumption of gas within the extended limits were small, though he admitted that it might be convenient for the Gas Company to have the power of going to the fringe of those limits for the purpose of supplying the people there; but there was no reasonable chance of employing capital profitably. It was premature to apply for a new site as large as that for which the Company were now asking for the purpose of constructing new gas-works. The Company had at Moor Lane a set of retorts not quite finished, which were calculated to produce an extra million cubic feet of gas per day. This in itself was about 40 per cent. upon the maximum daily production; and therefore, unless there was a very rapid increase in consumption, it would be a long while before the extra power was absorbed. A new element of competition had been introduced of late years in the shape of the electric light. It might be taken that every 1000 electric lamps of 8-candle power—the ordinary power by which they were calculated—would be the equivalent of a million cubic feet of gas; and he found that the Electric Lighting Company at Preston had now made such progress that they had 10,000 lamps supplying light equal to 10 million cubic feet of gas. That Company had been established a little more than two years; and their increase had been as follows: In 1892, 3670 lamps; in 1893, 4311 lamps. Consequently, since they had started they had made a very rapid advance. He did not suppose that that increase would go on continuously; but it must go on for another year or two, until the normal level of competition was reached. The factor of the competition of the electric light was a matter of very serious consideration as retarding the development of gas-works. The electric light was now so readily installed, in the case of the persons requiring wholesale illumination—the proprietors of cotton-mills and others—

that there would be a great temptation to put in their own electric plant. Having regard to the competition, he considered that any extension on such a large scale as that proposed was absolutely premature by about twenty years. There was no case at present that would justify the proposed interference with important undertakings belonging to the Corporation. He had come to the conclusion that £50,000 would be practically sufficient capital for the extension of the works for a long while to come. He agreed with Mr. Livesey and Mr. Woodall that it was right to protect the consumers, and to reduce the price to them as soon as possible by introducing a sliding-scale. In his opinion, a fair initial price, as between the Company and the consumer, would be 2s. 10d. per 1000 cubic feet.

Cross-examined by Mr. BIDDER: He did not pretend to have the practical experience of the gentlemen who had been called on the other side; but he had had very considerable experience of gas-works. While agreeing that it was to the disadvantage of the Company to spend money so extravagantly as to be unremunerative, they appeared to him to have laid out their capital in the past in such a reckless manner, that they ought not to demand the consideration of the Committee, or to be entrusted with further capital. Taking 23·35d. as the working cost, and 17·40d. which it was necessary to add in order to provide the statutory dividends, would produce practically 3s. 5d.; and, leaving out of account the capital which had been expended since 1879, this would be a fair initial price.

The CHAIRMAN: Have you estimated the length of time for which the £50,000 would cover the necessary extension of the works?

Witness: Fifteen or twenty years. The reason why I say this is that there are very large extensions already in hand; and there is the increasing competition of the electric light to be considered. I suggest that, if the Company had an additional sum of £50,000, it would put them on easy terms, and obviate the necessity for their borrowing from their bankers.

Do you think there would be no economy of manufacture if the proposed works were carried out on the new site?—None that I can see.

They would not have any cartage of coal, would they?—They would want the railway to bring their inland coal, or it must be carted.

Mr. *Joseph Hepworth*, M.Inst.C.E., examined by Mr. MOON, said that, after making a thorough inspection of the Company's works, which were in excellent condition, he concluded that they could make 1,500,000 cubic feet of gas per day in addition to their present daily production. The area at the disposal of the Company was between 12 and 13 acres; and the ordinary make of gas upon this area in other places was about 6,000,000 cubic feet. There were 798 retorts at the three works; and he calculated that they could be made to produce 5500 cubic feet of gas per mouthpiece. The maximum make at present was 2,800,000 cubic feet; and he considered that the plant available was capable of producing an additional 1,589,000 cubic feet, or a total of 4,389,000 cubic feet, which was 56 per cent. more than the present output. The Company had a storeage capacity of 3,200,000 cubic feet, which was 16 per cent. in excess of the maximum consumption; and that capacity could be easily increased to the extent of 50 per cent. There was a partially completed gasholder tank at Walton-le-Dale; and there was extra land at Ribbleton suitable for the erection of gasholders. In his opinion, the present works would be quite capable of turning out the quantity of gas required in Preston for the next twelve years at an annual rate of increase of about 4 per cent. per annum, which was much in excess of anything there had been during the last ten years. The proposed new works were, to his mind, not only entirely unnecessary, but very ill-devised. Having regard to the very large amount of capital expended per million cubic feet of gas made in the past, he believed that, if a sliding-scale was introduced in the Bill, the Company could exist and prosper with an initial figure of 2s. 10d. per 1000 cubic feet. He had made a very large number of experiments, with regard to the difference between the Argand and the batswing burner, with the gas manufactured at Carlisle, which was of the same quality as the Preston gas—the same quantity of cannel being used in its manufacture. He had made seven large quantities of gas, and the quality of these gases, tested by the "London" standard Argand, varied from 18·5 to 20·17 candles. Some 700 tests had been made; and they gave an average of 2 candles in favour of the burner now proposed to be used, as against the flat-flame burner described in the 1869 Act. His experiments were made with gas actually manufactured at the works, and not with experimental gas manufactured by Mr. Sugg.

Cross-examined by Mr. BIDDER: He suggested that the variations in the results obtained from the two experiments were largely due to the difference in the nature of the gas used. He could not understand how it was that Professor Lewes did not get better results, as the Carlisle and the Preston gas were both of 19-candle power, though the standard in the case of his (witness's) own town was only 14 candles.

Mr. BIDDER: Supposing an initial price of 2s. 10d. were adopted, would not the dividend upon the 10 per cent. original stock be reduced to between 5 and 6 per cent., and would not the dividends on the 7 per cent. stock be reduced to 4 per cent.?

Witness: No doubt the dividends would be considerably reduced; but it must be borne in mind that the Company have been employing a large amount of capital unprofitably.

Mr. *Henry E. Jones*, M.Inst.C.E., gave evidence to a similar effect.

The Committee then adjourned till the following Tuesday (to-day).

HOUSE OF COMMONS COMMITTEE.

(*Before Mr.* JACKSON, *Chairman; Mr.* H. F. PEASE, *Mr.* PAULTON, *and Mr.* ROUND.)

Friday, May 25.

THAMES CONSERVANCY BILL.

To-day the above-named Committee entered upon the consideration of the portion of the Thames Conservancy Bill by which it is sought to exact larger contributions from the various Water Companies and public bodies taking water from the Thames, with the view of enabling the Conservators to exercise more complete supervision over the river, so as to prevent its pollution.

Mr. LITTLER, Q.C., Mr. CLAUDE BAGGALLAY, and Mr. FRERE appeared for the Conservancy Board; the opposing Water Companies—viz., the Chelsea, East London, Grand Junction, Lambeth, Southwark and Vauxhall, South-West Suburban, and West Surrey Companies—and the London County Council (who acquiesced in the opposition) being represented by Mr. POPE, Q.C., Mr. COHEN, Q.C., Mr. PEMBER, Q.C., Mr. CRIPPS, Q.C., Mr. RICKARDS, and Mr. BATTEN.

Mr. LITTLER, in opening this part of the case for the Conservators, gave a summary of the various Acts under which the Water Companies obtained their powers of drawing water from the Thames. He said the maximum quantities which might now be taken daily from the river by the different Companies were: Chelsea Company, 22 million gallons; Lambeth Company, 24½ million gallons; Grand Junction Company, 24½ million gallons; Southwark and Vauxhall Company, 24½ million gallons; West Middlesex Company, 24½ million gallons; East London Company, 10 million gallons; West Surrey Company, 3 million gallons; and South-West Suburban Company, 1 million gallons. In addition to this, the Oxford Corporation took 5½ million gallons; and in the case of the Windsor Corporation, who had acquired the Windsor and Eton Water-Works, no one quite knew what they took. The flow of the river at Teddington Weir had never been found to fall below 200 million gallons after the abstraction of 134 million gallons by the Water Companies, and the 5½ million gallons by the Corporation of Oxford; so that the total quantity drawn was less than one-third of the entire bulk of water coming into the Thames in the very driest weather. The Conservators had always carefully opposed any further abstraction from the Thames; and the payments made by the various Water Companies had from time to time been increased by reason of the additional duties cast upon the Board with a view to the more effectual protection of the river and its tributaries from pollution. The present position of affairs was that the Chelsea Company paid £2800 a year; the Grand Junction Company, £3300 a year; the Lambeth Company, £3250 a year; the Southwark and Vauxhall Company, £3300 a year; the West Middlesex Company, £3300 a year; the East London Company, £2000 a year; the West Surrey Company, £50 a year; and the South-West Suburban Company, £115 a year. Of these amounts, a sum of £16,665 was attributed in the accounts of the Conservancy to the Upper Navigation, and £1450 to the Lower Navigation. In view of the increased powers conferred upon the Conservators by that part of the Bill which had already received the sanction of the Committee, and having regard to the extra duties of supervision, and so on, which would have to be performed, it was now proposed that the contributions of the various Companies should be augmented. The Royal Commission on Water Supply had reported that there was no objection to the present quantities of water being drawn from the river; and they had further expressed the opinion that considerable additional quantities might be taken without doing any mischief. The object of the Bill now under consideration was not to authorize in any way the abstraction of a larger bulk of water than the Companies could now legally take; but the Conservators asked that the Companies should be called upon to make considerably increased payments, particularly having regard to the statement in the report of the Royal Commission that no really satisfactory supervision could be exercised by the Conservators without a considerable augmentation of their staff of inspectors, which was now altogether inadequate for the purpose. This was accompanied by a suggestion that the necessary funds should be supplied by the Water Companies. Having done their duty in bringing forward the previous clauses of the Bill, which amended the constitution of, and consolidated, amended, and extended the powers of the Conservancy Board, and made further provision for the preservation and improvement of the river for purposes of navigation for profit and pleasure and as a source of water supply for the Metropolis, it became necessary to adopt the last-named recommendation of the Commission, because the Conservators saw no other source from which the funds could be provided. In no other way could those for whose benefit the water was kept pure be made to pay for it.

Mr. POPE: You do not contend that that recommendation of the Royal Commission was anything but *ultra vires* of their powers.

Mr. LITTLER said it was an expression of opinion; and he did not know any gentlemen who were more capable of expressing an opinion upon such a matter. Could anything be more idle than for the Water Companies to say that somebody else should supply the money? If the taxation were put upon shipping, upon the riparian proprietors, or upon the water consumers, while the control was in the hands of the Companies, one would imagine that even the most patient taxpayers would revolt. Therefore what was proposed, was, in the first place, that if at any time any work was done, or proposed to be done, by the Conservators which, in the opinion of any Metropolitan Water Company would injuriously affect either the flow or the purity of the water of the Thames above or at the place where any such Company obtained their supply, they might give notice to the Conservators, requiring them to alter such work, and that, unless the Conservators were willing to comply with such notice, the matter should be referred to an engineer to be nominated by the Board of Trade on the application of the Company or the Conservators; and that such referee should decide what should be done, and his decision should be final. Then it was proposed to increase the contributions of the Water Companies, and to constitute these contributions a first charge upon their receipts. According to the scheme of the Conservators, the increased payments would be as follows: Chelsea Company, £4800; Lambeth Company, £5450; Grand Junction Company, £5500; Southwark and Vauxhall Company, £5500; West Middlesex Company, £5500; East London Company, £3000; South-West Suburban Company, £215; West Surrey Company, £150.

The CHAIRMAN: That is a total increase of £13,000, I understand.

Mr. LITTLER said that was what it amounted to—the Conservancy Board taking upon themselves the extra duties specified in the Act. It was proposed to give the Water Companies the power of inter-sale as at present; and clause 289 of the Bill had been altered so as to bring it in accord with the instruction to the Committee that no further power of taking water should be granted. This clause enacted that the Metropolitan Water Companies, the West Surrey Company, and the South-West Suburban Water Company respectively should not abstract in any day a quantity of water from the Thames greater than

the quantity which might lawfully be taken on April 5, 1894—the date of the instruction. Then in the next sub-section it was provided that, for any water taken by any of the Metropolitan Water Companies, by the West Surrey Company, or by the South-West Suburban Company, out of any land under or within 500 yards of the Thames, should be deemed to be taken from the Thames. This clause was introduced in consequence of another set of paragraphs in the report of the Royal Commission, to the effect that the Thames, at the places where the various Companies took their water, was surrounded by gravel beds, and that, from the fall of the water, it was clear that any taken from those beds within a certain limit was water which would otherwise have found its way in the ordinary course of the gradient of the water through such strata into the river. Therefore, in order to ascertain fairly what was taken, the Conservators contended that any water drawn within 500 yards of the river should be regarded as being taken from the body of the river. Having regard to the instruction, he presumed that the Committee would desire to be satisfied that no more was obtained indirectly as well as direct from the river. Then there was a provision that suitable appliances for gauging the water taken were to be kept, and that the Companies were to make returns, to which the Engineer of the Conservators was to have access for the purpose of checking them. There was also a provision for arbitration in case of dispute between the Engineers. Lastly, there was to be a penalty of £100 for contravening the provisions of the Act, and a daily penalty in case of default.

Mr. POPE: Do I rightly understand that you propose to make statutory the specific quantity of water mentioned in your schedule?

Mr. LITTLER: No. If we were to make it statutory, we should go beyond the instruction to the Committee. All we want to do is to make it plain that, whatever quantity of water the Companies may now lawfully take, they may take in future, and no more.

Mr. POPE: We do not want more than we are now allowed to take.

The CHAIRMAN (to Mr. Littler): I understand that the amendment you propose is in order to make it clear that you have complied with the instruction that the powers given by this Bill shall not exceed the powers which at present exist?

Mr. LITTLER said that was the case, precisely. Then clause 290, which was the last one affecting the particular part of the Bill under consideration, ran thus: "Where any person is entitled, under any Act of Parliament, grant, custom, or otherwise, to any right of abstracting or appropriating water which might otherwise flow or find its way into the Thames, it shall be lawful for any such person on the one hand, and the Conservators or any other person on the other hand, to enter into and carry into effect an agreement or agreements for the conveyance of such right to the Conservators by deed, and shall, as from the date of such conveyance, be absolutely extinguished, to the intent that such water shall thereafter be allowed to flow into the Thames." Then there was power to the Metropolitan Water Companies to make contribution, either from capital or from revenue, in aid of any alteration for the purpose of increasing the flow, which was a convenient power both for the Companies and the Conservators. Turning to the petitions of the Companies, it would be found that the East London Company contended that the increased payments required to be made by them to the Conservators were unjust, and ought not to be sanctioned, inasmuch as it was not proposed by the Bill to confer upon the Company the right to draw any additional quantity of water from the Thames, but that, on the contrary, it was proposed to deprive them of certain rights which they at present possessed, under their Special Act, of taking water. They further submitted that there was no justification for limiting them to the quantity of water they now had the power to abstract, having regard to the report of the Royal Commission as to the quantity of water in the Thames available for the supply of water to the Metropolis and elsewhere; and they objected to such limitation. Oddly enough, the East London Company, so far from saying that the report of the Commission was *ultra vires*, as Mr. Pope had contended, prayed it in aid for their own purpose. Then, the Southwark and Vauxhall Company said that the daily quantity of 24½ million gallons was that which they were now entitled to draw from the Thames, for which they paid £3300; so that the payments to be made by them under the Bill would be very largely augmented without any increase in the quantity of water to which they were entitled, and no benefit commensurate with the additional taxation was proposed to be conferred upon the Company. They therefore considered the proposal unjust and unreasonable, and objected to it. Then, in the ninth paragraph, they said: "There does not appear to be any good reason for such limitation." So far as this was concerned, that was "past praying for," because the House had decided not only that there was no reason for it, but that it should not be increased. Then the Company proceeded to state that they were entirely desirous of carrying out the suggestions of the Royal Commission as to the construction of storeage reservoirs, and that they had introduced a Bill into Parliament with this object. After referring to the expense of measuring water, they alleged that their objections to the Bill were aggravated by the proposal to include, in the prescribed amount of their daily draught from the Thames, any water taken from land within 500 yards of the river. Obtaining, as they did, a considerable quantity of water by pumping from the gravel beds underlying their property on the north side of the Thames within the prescribed radius, they claimed to be entitled to this water, and to any other which they could procure by similar means over and above the quantity drawn from the river, and without any payment for it to the Conservators. This seemed to him exactly the issue that the Committee had to try. The Company admitted that they took a quantity of water from the gravel beds; and surely, if it was water which, but for them, would go straight into the Thames within so short a distance as 500 yards, the conclusion was clear that it came within the scope and intention of the instruction, which required that no further power of taking water should be granted. The Company did not appear to complain of the distance of 500 yards. All they objected to was the principle of any such water being included in the calculation. Then there was the petition of the associated Companies—the West Middlesex, Grand Junction, Chelsea, and Lambeth—who alleged that they would be injuriously affected by the Bill; that the proposed limitation was contrary to the report of the Royal Commission, which stated that 300 million gallons a day could, without injury, be abstracted from the Thames for the supply of the Metropolis; whereas the Bill only provided for the abstraction of 134 million gallons. This was, of course, covered entirely by the instruction. Then the associated Companies contended that the limit of 500 yards was far too wide; that some of them at the present time obtained large quantities of water within that limit, without injury to the river; that the limit should be considerably reduced; and that the sub-section should not apply to any water derived from wells, borings, or sinkings below the surface of the London clay. Subject to what the Engineer of the Conservators might say, this would probably be regarded as a reasonable limitation, because, if the water came from wells or borings into the London clay, it was not likely to be water which would have percolated into the Thames. Then they objected to the clause relating to the provision of measuring appliances, on the ground that they had already provided suitable appliances, in the shape of pumps which accurately showed the quantity of water abstracted. If this were proved to be the case, they would be deemed to be sufficient. If not, the Engineer to be appointed would decide, as between the Companies and the Conservators, what were the proper appliances to be used. Then they objected to make weekly returns as to the water daily abstracted by them from the river, and also to the penalties, as being excessive. With regard to clause 290, they contended that it was solely the duty of the Conservators to maintain the flow and purity of the river; and that, so long as the right of the Companies to abstract water was limited to a fixed amount, it was difficult to see how they would derive any benefit under the clause. In making this allegation, they certainly seemed to "cut their own throats" with reference to any objection with the larger contribution. Lastly, the West Surrey Company objected to the Bill as prejudically affecting their rights, property, and interests. There was the same fallacy again, because they were not being asked to make the extra contributions for the water at all, but for securing that they should have thoroughly pure water for the purposes of their works. Then they talked about breach of faith. This, of course, was merely put in by the draftsman, as nobody could suppose that the Conservators desired to break faith with anyone.

The following evidence was then given:—

Mr. *J. H. Gough*, Secretary to the Thames Conservancy Board, was then examined by Mr. CLAUDE BAGGALLAY as to the various agreements which had been entered into between the Metropolitan Water Companies and the Conservators. He said that in the year 1852 the Chelsea Company, having obtained an Act which enabled them from the (then) present time to take water above Teddington Lock, entered into an agreement with the then Conservators of the river—viz., the Corporation of London—under which the Company were allowed to draw 20 million gallons of water a day, and undertook to pay a sum of £300 a year to the Corporation. This agreement was subsisting with the present Conservators; and the £300 a year was allocated to the purposes of the Lower Navigation. In 1875, the Chelsea Company obtained additional powers, which enabled them to draw an unlimited quantity of water from Seething Wells; but those powers were not exercised. In 1886, a further agreement was entered into between the Chelsea Company and the Conservators, under which the latter consented to the Company abstracting a further quantity not exceeding 2 million gallons a day; and the Company agreed to contribute to the funds of the Conservators £500 a year. The average daily quantity of water which the Company had taken from the river for some years past had been about 12 million gallons a day. The Grand Junction Company, which previous to 1852 took their water from the Grand Junction Canal, in that year obtained power to draw water without restriction from the Thames at Hampton; but, just before the passing of the Act, they entered into an agreement with the Corporation of London, limiting the bulk of water to be taken to 20 million gallons a day—the Company agreeing to pay £300 a year. This sum had been received by the Conservators up to the present time. In 1886, a further agreement was entered into, under which the Conservators consented to the abstraction of an additional 4½ million gallons of water a day; and the Company agreed to pay £1000 per annum. In the case of the Lambeth Company, under an agreement entered into in 1851, they were empowered to draw 20 million gallons daily; and they paid £200 a year to the Corporation. Under a subsequent Act, obtained in 1871, the Company were required to pay to the Conservators £250 instead of the £200 a year under the agreement with the Corporation; but this Act did not prescribe the quantity of water which might be taken. In 1886, the Lambeth Company entered into an agreement under which they were to draw 4½ million gallons of water a day, in addition to their original 20 million gallons, and to pay to the Conservators £1000 per annum. There was no statutory restriction upon the quantity of water the Company could take; but it was entirely limited by agreement with the Conservators. In the case of the Southwark and Vauxhall Company, they formally entered into an agreement with the Conservators to pay £1000 a year on condition of their being allowed to take a further 4½ million gallons over and above the 20 million gallons prescribed by the agreement entered into with the Corporation in 1852.

Mr. BAGGALLAY: So far as the Conservators and the Southwark and Vauxhall Company are concerned, has there ever been a suggestion until this moment that it might be beyond the power of the Company to enter into that agreement?

Witness: No.

Mr. POPE: I do not understand how a company which has statutory powers and obligations can agree with anybody not to discharge them, or to limit the power to discharge them in the case of an unlimited duty to supply a district with water, and an unlimited power to take that water from a certain source. How is a statutory company to agree with itself that it will not take more than a certain quantity of that which has to be supplied? It cannot do it. I shall ask the Committee to say that this question is so bound up with the whole question of the water supply, that it ought not to be interfered with in one way or another.

Mr. BAGGALLAY: I hope my learned friend will make the matter clear.

Mr. POPE: There is a great deal of evidence required before you can begin to interfere with either statutes or agreements.

The Committee then adjourned till the following Monday.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Friday, May 25.

(*Before Mr. Justice* CHARLES.)

Baldry and Another v. The Mayor and Corporation of Swansea and Ralph Henry Wyrill.

This was an action in which the plaintiffs claimed a sum of about £65,000 from the defendants in respect of certain water-works which they had carried out for the Swansea Corporation at Lliw, under a contract dated Aug. 26, 1886. The case was one of such an exceedingly complicated character—involving the necessity of continuous reference to plans—that it was quite impossible for a Court constituted in the ordinary manner to try it; and, before the conclusion of the opening, it was referred to a member of the Bar for hearing.

The statement of claim set forth that the defendant Wyrill was the Borough Engineer of Swansea. The Corporation being desirous of erecting the works referred to, the Engineer prepared certain plans and specifications. It was provided that the clay to be used for the clay puddle should be selected from the most suitable clay in the neighbourhood, and should be equal to a particular sample of clay which was exhibited in the Engineer's office. The plaintiffs saw Mr. Wyrill; and they informed him that their tender would be based on the assumption that he, as Engineer, would specify and approve of the description of pitching and masonry to be used, and that they would be allowed to use gunpowder if and when they came to rocks in the trenches. The plaintiffs alleged that, in breach of this promise, the Engineer refused to permit them to execute the pitching and masonry as agreed, and thereby much increased the cost of the works. Suitable clay was not found in the neighbourhood; and the plaintiffs therefore acquired clay on the Abergwili Estate, and paid for wayleaves, &c., and besides this they constructed a railway thereto. Notwithstanding this, the Engineer refused to allow the plaintiffs to use the clay, and compelled them to use a superior description, which was ultimately found in the Clydach Valley. The works were thus greatly delayed; and the plaintiffs alleged that they were compelled to abandon the railway they had made, and to pay for additional wayleaves and construct another railway. They also alleged that the works were greatly delayed by the defendants neglecting to supply certain fittings, by delaying giving certain orders to commence work, and by stopping the works while deciding what materials should be used. The plaintiffs further alleged that the works were delayed for long periods by reason of the Engineer "fraudulently and in collusion with the Corporation," acting by their Water Committee, delaying to certify both for extras and for contract work, and by reason of his refusing to exercise and act upon his own judgment in the matter. The plaintiffs submitted that the Engineer was liable on the promises made by him; and if he had no authority to bind the Corporation, he was liable for implied warranty that he had such authority. The defendants admitted the first statement, with regard to the contract terms, except that they said the Engineer's engagement was a yearly one and terminable at six months' notice. They denied the charges of bad faith and collusion brought against them; and they stated that they acted throughout in good faith, and under the terms of the contract made between them and the plaintiffs, and in the belief that their Engineer was *bonâ fide* discharging the duties imposed upon him. The Corporation brought £1949 17s. 11d. into Court; alleging that this sum was enough to satisfy plaintiffs' claim with respect to extras.

Sir R. E. WEBSTER, Q.C., M.P., and Mr. W. GRAHAM appeared for the plaintiffs; Mr. FINLAY, Q.C., Mr. BOWEN ROWLANDS, Q.C., Mr. H. H. HUDSON, and Mr. S. J. EVANS represented the Corporation; and Mr. LAWSON WALTON, Q.C., and Mr. BENSON were for Mr. Wyrill.

Sir R. E. WEBSTER, in opening the case, stated that probably, in the course of it, it would become quite impossible for his Lordship to deal with a very large number of the items, because they were such as could only be understood and followed out by some one sitting at a table with all the plans before him and making a thorough investigation of the details relating to the various points. He hoped, however, to have the benefit of his Lordship's decision upon certain main principles, which would be a guide to whomsoever had ultimately to deal with those details. The action had been brought against the Corporation and their Engineer; and it was founded practically upon the contract itself. After some further remarks upon the nature of the claim, the learned Counsel said he wished at once to say that it had been thought by the defendants—he did not consider either rightly or fairly—that the plaintiffs charged the Engineer and the Corporation with fraud. The words "fraud and collusion," he admitted, were used in some of the proceedings; but the explanation given in writing more than once, and verbally over and over again, showed that this was not the case that the plaintiffs were there to present. He said this at once, in order that it could not be suggested by anyone that he was doing it by way of pressure from his learned friends. In the sense of any misconduct on the part of Mr. Wyrill, as a man of honour, he made no charge against him. But in the course of the case, he would have to show that certain certificates, upon which his friends relied, were not the Engineer's certificates, but those directed by the Corporation; or, in other words, that they were not given by Mr. Wyrill as an independent Engineer. He wished it clearly understood that he did not intend to open a case founded upon an independent promise by the Engineer outside the contract; nor did he urge against Mr. Wyrill anything that could be considered as being a charge against him, either as a man of honour or as a gentleman, of having acted otherwise than perfectly *bonâ fide* and honourably.

Mr. FINLAY: Nor as against the Corporation?

Sir R. E. WEBSTER said he desired to say at once, in the frankest way, that if it was thought the plaintiffs' case depended upon any charges of fraud, he did not intend to rely upon any such causes of action, whatever consequences might follow. The learned Counsel then proceeded at length to give a detailed history of the case; and the Court rose.

Monday, May 28.

On the resumption of the hearing this morning,

Justice CHARLES expressed the opinion that, from what he had gathered of the case, it was one that must eventually be referred; and it seemed to him a waste of both time and money to try it in piecemeal fashion.

Mr. FINLAY said that, now that the plaintiffs had so explicitly stated, through their Counsel, that there was nothing like a charge of fraud imputed against either the Corporation or their Engineer, he had no objection to such a course.

His Lordship then saw Counsel in his private room; and the case was finally referred to a member of the Bar.

Wednesday, May 30.

(*Before Justices* CAVE *and* COLLINS.)

Mills v. Todmorden Water-Works Company.

This was an appeal from the decision of the County Court Judge of Todmorden in an action pending from October till April last, brought by the plaintiff to recover damages from the defendants, in respect of an overflow from a flush-cistern. The plaintiff, who carries on the business of a tailor, claimed £35 for injury to his goods; and the County Court Judge gave judgment in his favour upon the ground that there had been negligence upon the part of defendants' servants.

Mr. TINDAL ATKINSON, Q.C. (with him Mr. SCOTT FOX), who appeared for the appellants, said the injury for which the plaintiff claimed was caused by water overflowing a cistern in an upper part of the premises, and percolating through the different floors until it reached the basement, where the goods were stored. The defendants' inspector, who had found the cistern leaking—or rather the ball-tap leaking—had gone in, and put on a new washer; and the plaintiff alleged that this was of an improper kind, so that it allowed the tap to leak, with the result that ultimately the water found its way into the shop on the ground floor.

Justice CAVE asked whether the defendants were paid for putting in new washers.

Mr. ATKINSON replied that they were not. They did it for their own benefit, so as to prevent waste of water.

Justice CAVE: Then the defendants did not make the thing any worse than it was.

Mr. ATKINSON: Not a bit. The County Court Judge found that the actual cause of the overflow was an obstruction in the soil-pipe, which really belonged to the plaintiff; and that there was not a tittle of evidence to show that the Company's inspector was responsible for this, in any shape or form. He had only found one item of negligence in the whole case—viz., that the washer which the defendants put on was defective.

Justice CAVE: I suppose the new washer was really no better than the old one.

Mr ATKINSON said no doubt that was so.

Justice COLLINS asked whether the County Court Judge found the mischief was attributable to the act of the defendants' servant.

Mr. ATKINSON said he drew the inference that there must have been something done by the inspector, when he put on the washer, which had the effect of blocking-up the waste pipe.

Justice CAVE supposed that, if the overflow-pipe had been in proper working order, no damage could have resulted.

Mr. ATKINSON said no doubt that was so; but no evidence had been given to show how the pipe became obstructed. This pipe, instead of going into the open air, went into the flush-pipe; and the evidence proved that the obstruction occurred in the soil-pipe, as the water which overflowed came from the seat of the closet.

Mr. WHATELEY (who appeared for the respondent) said his learned friend, in his argument, had really assumed that all the facts were found in favour of the Company; whereas the learned Judge found exactly the other way. The overflow-pipe in question had been passed by the servants of the Company; so that it could not be said that the pipe was of an improper kind. There had been a slight leak in the apparatus in April last year, and again in June, in consequence of which the plaintiff sent to the Company for their workmen to attend to the matter. In response, a man came who put on a washer, which was utterly useless. It split in half, and caused a large quantity of water to overflow. The Company said that they had not put on an improper washer; and, further, that the overflow was caused by having an improper overflow-pipe. But the plaintiff contended that the water came not from the seat of the closet, but from the top of the cistern, in consequence of the 1-inch overflow-pipe not being sufficient to take away the surplus water from the cistern.

Their LORDSHIPS said that, as the parties could not agree upon the facts, it would be necessary for them to consider the evidence given before the County Court Judge.

This was then read *in extenso;* and, at its conclusion,

Mr. ATKINSON was heard at some length in reply.

Justice CAVE, in delivering judgment, said he was of opinion that the appeal must fail. At first he was inclined to think there was something to be said on behalf of the defendants; but the investigation which had taken place, and the very careful argument of Mr. Atkinson, had satisfied him that the judgment of the learned County Court Judge was given upon the facts—and he thought it was a right judgment upon the facts. As between the plaintiff and the defendants, the Company undertook the duty of stopping the inlet of water into the cistern. They sent a man to do this; and the County Court Judge had found that he did it so negligently as not to stop the inflow of water into the cistern. But for this, the accident would not have happened. Every pipe of the place might have been stopped up; but if the work had been properly done by the inspector, the accident could never have occurred. Then it was said: "Oh, but there was a leakage there before; and consequently if the man had done nothing the accident might have occurred." Undoubtedly, if the man had done nothing, the defendants would not have been responsible. But, unfortunately, they did undertake the duty of stopping the leak; and they were bound

to use careful and proper means in so doing. This they did not do. They used improper means, and did the work so carelessly and negligently, that the water continued to come in. It was in consequence of the water so coming in that the cistern overflowed. That this was really a question of fact, and not of law, was manifest, because the findings of the County Court Judge were sufficient to dispose of the case. It was enough to say that there was a duty undertaken by the defendants; that this duty was so negligently performed that the water continued to come in; and that if the duty had been properly discharged, the accident would not have happened. Whether the accident occurred by reason of the overflow-pipe being insufficient to take away the water coming in in its natural state, or owing to the pipe being blocked, was quite immaterial. The accident would not have happened had it not been for the negligence of the defendants' man. That this was, after all, really a question of fact and not of law, was shown by this—that Mr. Atkinson had, for the first time, started the theory that the accident might have been owing to a stoppage in the soil-pipe. But a witness who was called for the plaintiff stated that it was caused by an overflow from the cistern—the overflow-pipe being unable to take away the water which came in through the defective washer; and the witness did not appear to have been cross-examined on this point. Therefore, this explanation was accepted as the cause of the accident. No matter what pipe had been stopped up, there could have been no overflow if the inspector had done his duty properly. He did not do it; and the deluge was traceable to this fact. There being no contributory negligence on the part of the plaintiff, the appeal failed; and it must be dismissed, with costs.

Justice COLLINS said that he was of the same opinion, and for the same reasons.

Mr. ATKINSON said if the defendants were answerable for defective washers put upon the taps by their workmen going round, in the interest of the Company alone, for the purpose of stopping waste, it would be a very serious matter to them to be held responsible for any small act of negligence.

Justice CAVE said the Company must be responsible for causing an overflow which would not have been caused but for the act he had referred to. If the Company carelessly omitted to discharge a duty which they took upon themselves, they must abide by the consequences. The Company had power given to them to do the work; and they must do it properly.

Mr. ATKINSON asked to be permitted to give one illustration to show the hardship upon the Company.

Justice CAVE said they could not listen to any further argument—judgment having been already delivered.

Mr. ATKINSON said he merely wished to ask for leave to appeal, as the case was an important one to water companies.

Their LORDSHIPS refused to give it.

An Artesian Well for the Crays Gas Company.—An artesian tube-well, 4 inches in diameter and 60 feet deep, has just been put down at the gas-works at St. Mary's Cray, by Messrs. Le Grand and Sutcliff, of London. The boring was completed in a week; and a supply of between 4000 and 5000 gallons and water per hour is readily raised from the well by a Gordon duplex steam-pump.

Tipton Local Board Gas Undertaking.—It was reported by Mr. D. Hipkins at the meeting of the Tipton Local Board last Tuesday that the gross profit on the working of the gas undertaking during the past financial year had amounted to £3624; but this sum had not been sufficient to meet the interest and repayments of loans by £572. There seemed, he remarked, to be a wrong impression abroad with regard to the gas-works—that the undertaking was an unfortunate one. On the whole, it had been very successful. Every year they paid off interest and loan; and when the works were paid for, they would be the absolute property of the ratepayers. It was not the fact that a less consumption of gas had been caused by a rise in price, because not one consumer had been cut off.

The Duke of Northumberland and the North Shields Water Company.—"A Consumer" wrote last week to the *Newcastle Daily Chronicle* anent the relations of the Duke of Northumberland with the North Shields Water Company; and certainly, as he says, the position occupied by the former "would be amusing were it not that it involves heavy expense upon people who can ill-afford to pay for any kind of entertainment." It appears from the letter that the Water Company were established in 1786, with a capital of £2000; and in consideration of permission being granted by the Duke of Northumberland to take water from his land, he was to receive one-seventh of the clear annual profits. This capital was, of course, increased from time to time to meet the requirements of the district; and the Duke was paid on one-seventh of the net profits on the whole capital, though receiving a rental for any land used, which might have been added subsequently to the estate. One would have thought, says "A Consumer," that the one-seventh should have been confined to the original £2000 under these circumstances. The present Duke, however, insisted on being paid one-seventh of the gross revenue—that is to say, not upon the results of the share capital of £60,000, but upon that, and the employment of £36,000 borrowed money on mortgage; and, in a hasty legal decision, he obtained judgment for this, and receives for the past year £583, or one-third as much as the whole of the shareholders obtain. This is the more extraordinary because only a portion of the water supplied by the North Shields Company is now taken from the Duke's land, and still less from land which was ducal property when the bargain was made; for unfortunately the North Shields Water-Works are in the midst of a colliery district, and since they were commenced ducal and other land has been sold for collieries, quarries, and building purposes, which have drained the Company's gathering-ground, and polluted the water; so that last year the Shields Company paid the Newcastle Company no less than £2967 for water supplied, which should have been gathered from the Duke's land, yet from which the Duke will receive one-seventh of the profit. The letter concludes by remarking that "the newly-developed zeal exhibited by the Duke's advisers in the House of Lords, and which is to be repeated in the House of Commons on the subject of the North Shields water supply, can therefore be appreciated in its proper value."

MISCELLANEOUS NEWS.

THE ANNUAL REPORT OF THE CHIEF INSPECTOR UNDER THE ALKALI ACT.

The Thirtieth Annual Report of the Chief Inspector under the Alkali, &c., Works Regulation Act, 1881 (Mr. A. E. Fletcher), embracing his proceedings during the past year, was presented to the Local Government Board and to the Secretary for Scotland in March; and it was issued last week as a parliamentary paper. As on previous occasions, we extract those portions which have the greatest interest for our readers.

Mr. Fletcher opens his report by saying that the Alkali Act Amendment Act passed in 1892 brought several new manufacturing processes under its provisions. The number of works registered in England, Ireland, and Wales up to the close of 1893 was 1046; showing an increase of 136 on the preceding year. There are also 127 works registered in Scotland, concerning which a separate report is presented. The increase in the work of inspection caused by the above-named Act is, however, best shown by the number of distinct processes of manufacture that now come under it, and several of these may be carried on at a works previously registered. There are now 1495 processes under inspection, as against 1225 in 1892; showing an increase of 270. Adding the 208 processes under inspection in Scotland, the total number is 1703. Of the works now on the register, a small minority only are alkali works; the larger number being those in which some of the processes named in the schedules to the Acts of 1881 and 1892 are carried on.

The number of visits made by the various District Inspectors last year was 4824; the number of tests being 4613. The results are set out in a table giving the average amount of acid gases escaping in each district; and it is gratifying to find that the noxious gas, though now much below the legal standards originally imposed, diminishes year by year. There were four prosecutions under the Act last year; one of the offending parties being an Irish Gas Company, who had to pay a penalty of £9 for not registering their works.

The class of works which gives the name to the Act—viz., alkali works—now fills a gradually diminishing space in comparison with the other works that have been brought in. Of the 1046 works now registered under the Act, only 101 are there as alkali works; and in only 58 of these is the old alkali or soda-making process carried on. The remaining 43 are so registered because the work done in them comes within the original definition of an alkali works made use of in the Act, though no soda-making process is carried on in them. For several years the ammonia-soda process has been a severe competitor with the older Leblanc method; and as far as the production of the main article—soda—is concerned, it has outstripped its rival. By its means, however, there is no production of hydrochloric acid, chlorine, or bleaching powder; so that as these are ever in request, the older process has maintained its ground by their help. They are the bye-products of the original manufacture. The ammonia process has, however, made steady advance upon that of Leblanc; and it now nearly equals it in the production of soda. It is, therefore, a matter of surprise to observe that the older process, which has flourished for more than a century, but seemed now to have received its death-blow, has shown such renewed vitality in the last 18 months, that during this time five new Leblanc works have been started, all of which are in operation. The total quantity of salt decomposed in the Leblanc process last year was 467,562 tons; by the ammonia-soda process, 349,609 tons—making a total of 817,171 tons.

With regard to sulphate of ammonia works, Mr. Fletcher expresses satisfaction at being able to report that no complaint was brought during the year against any of them. He says that, "though this formerly most offensive manufacture is carried on at 368 places in England, &c., and at 59 places in Scotland—in all at 427 works—yet the public may be said to be quite ignorant of their presence. Many of the places where the operation is carried on are in crowded neighbourhoods, and even in fashionable watering-places, for the chief material employed is the condensed water of the gas-works; and as the carriage of this to a distance is expensive, the manufacture of the sulphate of ammonia is best performed on the spot." The liberated sulphuretted hydrogen is now so far controlled, that no one outside the factory is aware that the manufacture exists. He considers that this immunity from nuisance has probably led to an extension of the manufacture where formerly, from ignorance or otherwise, the material was wasted—fearing the complaints that might arise if attempts were made to use it. The quantity produced has still further increased. It has now reached 152,762 tons, which, at present prices, has a value of more than £2,000,000. This considerable sum is the reward for carefully saving that which at one time was wasted or rejected—the mere rejection causing a nuisance. The following table shows the principal sources and the amount of the sulphate of ammonia produced in the United Kingdom in the years named:—

	1893. Tons.	1892. Tons.	1891. Tons.
Gas-works	112,179	110,748	107,950
Iron-works	8,833	11,000	6,290
Shale-works	28,485	23,105	26,600
Coke and carbonizing works	3,265	4,973	2,766
Total	152,762	149,826	143,606

These figures show that the increased production has been in the gas and the shale-distilling or paraffin-oil works; while in the iron and the carbonizing works there has been a falling off, in consequence of the stoppage of many of the works during the recent coal strikes.

An important section of the report is that which is devoted to tar-works, the inclusion of which under the Act has, Mr. Fletcher states, added very greatly to the cares of the District Inspectors. Already 118 works have been registered. The conditions of these are by no means identical; and the arrangements for preventing the nuisance too often arising from such works have been studied afresh in very

many cases. The works differ one from another, partly because the material with which they deal—the tar from gas-works—is by no means uniform. This necessitates a special adaptation as to form and size of still and the method of working; so that precautions necessary in some cases are not applicable in others.

At present, two parts of the process of tar distillation have been kept in view as being those requiring first attention with the object of minimizing the nuisance. These are, first, the free gases which escape from the condensers of the tar-stills. They contain sulphuretted hydrogen, particularly at the beginning and the end of the operation; and also a considerable amount of light hydrocarbon vapour, which does not condense at the usual temperature of the worms. Several methods have been successfully employed to prevent the escape of these gases. In some works they are led away by means of a steam-jet or a fan, and brought to a fire, where they are readily consumed. In most cases, a water-seal is introduced between the still-worm and the furnace, to prevent firing-back; though in some cases sufficient protection from this is thought to be secured by reducing the size of the pipe as it approaches the fire. In other works, these gases are made to pass through a bed of oxide of iron, in which the sulphuretted hydrogen is decomposed, and the accompanying vapours condensed. In others, again, the oxide of iron is replaced by slaked lime. Various methods have been adopted for collecting these gases. Some fix to the end of the tar-still worm a swan-neck bend, which thus traps the gases; and they are led away by an upcast pipe. These pipes from all the stills unite in a main pipe, by which they are conveyed to the furnace or the condensing apparatus. Perhaps a preferable plan is for the worm end to discharge into a box with an air-tight cover, from the upper portion of which the gases can be led away. Great difficulty has been found in dealing with these gases of the tar-stills in the eastern counties, where, in many works, the tar is found constantly to have a tendency to form a carbonaceous deposit in the still. This from time to time is liable to be in part suddenly removed, so as to expose the over-heated bottom of the still. A violent eruption then takes place, which would be dangerous if there were an obstruction such as would be offered by a bent pipe or closed box at the end of the worm. The most serviceable arrangement there is the plain worm end fitted with a loose cap, from which a pipe rises to lead off the gases referred to.

The second important part of the tar-works that has called for attention is the pitch-bay. This is an open shallow tank of extended area, into which the pitch is allowed to flow from the stills after the volatile portions have been distilled off. The temperature at the finish is very high. If the pitch were allowed to flow into the open air while at full heat, an abundance of very acrid vapour would arise from it, sufficient to cause considerable nuisance both inside and in the neighbourhood of the works. It is, therefore, allowed first to flow into an intermediate closed vessel, where it may cool. It should, however, be removed from this while still warm enough to flow. The temperature must depend on the character of the pitch, three grades of which are commonly known—viz., "hard," "medium," and "soft"—depending on the length to which the distillation has been carried; or more frequently the pitch may have been hard, but softened by admixture with tar oil when in the intermediate or cooling vessel. Soft pitch will flow into the bay at a temperature of 160° Fahr.; but the hard pitch must have a temperature of from 300° to 400° Fahr. In some tar-works, an outflow chamber, styled a "French weir," is constructed between the still and the pitch-bay. It is a brick tank, with a division which does not reach to the bottom. The compartment on the still side of the division is closed in. Into this the hot pitch flows, and for an outlet must pass under the dividing wall; then, welling up in front, it overflows into the pitch-bay. When a fresh charge of hot pitch flows from the still, it displaces that which was already in the chamber and has become cool. This is pressed forward, and made to flow into the bay; while the hotter portion taking its place waits in its turn until it has had time to cool. Some manufacturers have covered in these pitch floors with walls and roofing of galvanized iron. This is, however, chiefly applicable where soft pitch is worked. In the case of hard pitch, explosive fires have been occasioned by covering the bay.

Mr. Fletcher thinks it would be very desirable that all pitch-bays should be covered in; but, for certain reasons which he gives, this cannot always be done. The pitch should, however, be kept in the still or cooler as long as is consistent with its flowing out into the bay. The methods of dealing with the uncondensed gases from the tar-stills, the method of cooling the pitch, the temperature at which it enters the pitch-bay, and other details concerning the sanitary arrangements of tar-works, differ so much in various works, that, for the sake of better comparison, Mr. Fletcher has arranged such information as he has obtained on these points in tabular form. Time did not suffice to make it complete; but he says it is satisfactory to find that many of the manufacturers have already adopted means for dealing with those portions of their works from which nuisance is most liable to proceed. In connection with this part of the report, reference is made to a continuous tar-still devised by Mr. F. Lennard, of Messrs. Forbes, Abbott, and Lennard, some particulars in regard to which we must defer till a future occasion. The Chief Inspector thinks Mr. Lennard may be warmly congratulated on the advance he has made.

The report closes with some remarks on the work of the District Inspectors. Mr. Fletcher says the great increase in the number of processes which now come under the Act has necessarily entailed much additional work. To meet the pressure felt in the East Lancashire and Yorkshire districts, 23 works have been transferred to the district embracing Northumberland and Durham; and some further adjustment may be necessary, as the number of processes to be inspected in the first-named district is still excessive. He expresses great satisfaction at the large amount of arduous labour the District Inspectors accomplished last year in bringing so considerable a number of new works into conformity with the requirements of the Act. "Yet," he says, "the vista before them is ever open. Their goal recedes; for the Act enjoins that the '*best* practicable means' shall be employed for preventing the escape of noxious vapours. Duty, therefore, advances with knowledge."

Mr. Fletcher's report is followed by the reports of his assistants. They contain some highly interesting details, which will be noticed on a future occasion. With the report is given, in response to many applications, a collective index of all the annual reports published under the Alkali Acts since the date of the original Act of 1863.

THE CONVERSION OF TAR INTO GAS.

An Experiment at the Bangor Corporation Gas-Works.

About a year ago, the Bangor Town Council sanctioned the expenditure by the Water and Gas Committee of a sum of £70, to enable them to carry out some experiments on the conversion of tar into gas by a process devised by their Gas Manager (Mr. J. Smith), the plant for which was described and illustrated in the JOURNAL for the 8th ult. A Sub-Committee was appointed to take the matter in hand; and they reported thereon at a special meeting of the Committee on the 15th ult. The Committee passed a resolution expressing general satisfaction with the results, but deferred giving a decision as to spending money on further plant until they had had another meeting. The following are the principal portions of the report:—

At the time the experiment was first made, tar was selling with great difficulty, owing to a glut in the market, at 7s. per ton. Mr. Smith then conceived the idea of carbonizing it for the production of gas. Gas, as the Committee are aware, is usually made by the carbonization of coal or cannel in clay retorts; the material used in heating the retorts being coke. Mr. Smith, acting upon the resolution of the Council, purchased an iron retort, which he thought would answer the purpose better. Into this he ran a small stream of tar, which, dropping on the bottom of the retort, heated by a coke fire, was carbonized in a way similar to coal in like circumstances. The gas evolved during the process passes out; leaving a residuum of tar coke on the bottom of the retort. On issuing from the retort, the gas enters the hydraulic main in the form of vapour. Here the vapour condenses, and the gas collects at the top of the pipe, while oil is deposited on the bottom. This oil, if allowed to cool, will deposit crystals of naphthalene, and leaves residual oil (creosote oil). The oil thus obtained, Mr. Smith returns to the retort for further carbonization. It was at this point that the first difficulty arose. It was found that the oil required a much greater heat to convert it into gas; and that the overheating caused stoppages in the pipes, and injured the retort. The residuals from the oil were also difficult to dispose of; and the quantity of gas evolved was small. If this residual oil had been allowed to run to waste, the quantity of gas produced from the tar would not only have amply justified the Committee in incurring the expense of making the experiment, but would also have shown considerable profit over the market value of the tar. But Mr. Smith was not satisfied with the results obtained, as they fell slightly short of the anticipations he had laid before the Committee. He then turned his attention to the more profitable utilization of the residual oil; and he conceived the idea of using it instead of coke as fuel for heating the retorts. He suggested that, if a spray of oil were forced into a furnace, it would burn with intense heat. This was soon demonstrated on trial; and he applied to the Council for permission to purchase a special burner which would distribute the oil in a fine spray within the furnace, and so conduce to its more rapid and complete combustion. The burner was tried for a week; and it proved unsatisfactory. The spray produced was not sufficiently fine, and the oil was not readily consumed; and consequently it failed to produce enough heat for the retorts. Mr. Smith then substituted a burner of his own invention, which answered the purpose admirably, and is now in operation. A small pipe of oil is within a pipe of steam. A jet of steam issues from one pipe at the same time as a jet of oil comes from the other; and the oil, mingling with the steam, is forced to a considerable distance within the furnace in a fine spray, which, being fired, becomes a tongue of flame about 18 inches long. In this manner sufficient heat is generated within the urnace to heat six retorts. The oil produced by the carbonization of a ton of tar is sufficient for this purpose for four days. It would have required 48 cwt. of coke, of the value of (say) 32s., to do the same amount of work.

The net result of carbonizing a ton of tar may now be set down as follows:—

One ton of tar	£0	11	0	9700 cubic feet of gas produced, at 3s. 9d.	£1	12	4
Labour	0	3	2	Tar coke, 8 cwt., at 8d.	0	5	4
Fuel	0	6	4	Value of coke saved by oil used as fuel	1	12	0
Interest and depreciation	0	1	0				
Distribution charges	0	2	5				
Total cost	£1	3	11				
Balance of profit	2	5	9				
	£3	9	8		£3	9	8

It should be noted that, when the experiment was first decided upon, tar was worth only 7s. per ton. Its present value is 11s. per ton; and the above account shows that by carbonization we get £2 16s. 9d. for every ton. The Committee will at once see that this will amount to a very large saving in the course of a year.

The results anticipated by Mr. Smith, when he first suggested the experiment, appeared to most of the Committee so remarkable that they, with several members of the Council, showed considerable reluctance in accepting his figures; and much difficulty was experienced in the Council in getting the necessary resolutions passed. The Committee, therefore, resolved that the experiment should be subjected to the severest tests. They obtained permission to purchase the requisite plant; and £104 has already been expended. In order that the results may be continually tested, it will be necessary to obtain further plant, of the value of £17 10s. The objects aimed at are: (1) To measure or weigh the tar used before it enters the retort; (2) to receive and purify the gas evolved; and (3) to measure the gas after it has been purified. It has been found that measuring the gas before purification injures the meter, and will soon render it useless.

The Sub-Committee are satisfied that the tests already made are amply sufficient. It has been shown to them that 26 tons of tar have been used, and 250,750 cubic feet of gas produced, since the present plant has been in operation to the 25th of March. This will give an average of 9642 feet per ton. A special test has also just been made, which showed that one ton produced 9700 cubic feet. This result is sufficiently near the average given above to justify the conclusion that the yield shown in the estimate of cost, &c., is accurately stated.

If the Committee are dissatisfied with the above tests, it will be necessary, as already stated, to incur the expenditure of £17 10s. in setting up purifiers to clean the gas before it enters the meter. If, on the other hand, the Committee are satisfied, the measurement will be abandoned, and the gas passed from the hydraulic main to be purified with the coal gas. The condensers and the meter would be thrown out of use; but they could be utilized for other purposes, at a saving on this account of £36 10s. The Sub-Committee therefore suggest that this should be done. The experiment, in their opinion, has been fully tested, and with eminently satisfactory results. They, therefore, think that the further expenditure of £17 10s., and the continuous use of the condensers and meter, are superfluous. The Sub-Committee further propose that a new bed of five retorts be set up to provide for the next winter, and that two of these retorts should be utilized for the carbonization of tar, and three for coal, in the ordinary way. The expenditure on this head would probably not amount to £66. Against this amount the sum of £54 may be placed—viz., the saving in the cost of purifiers £17 10s., and the value of the plant thrown out of use, £36 10s.

MONTE VIDEO GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at Winchester House, Old Broad Street, E.C.—Mr. A. K. Mackinnon in the chair.

The Secretary (Mr. A. G. Hounsham) read the notice convening the meeting; and the Directors' report and accounts, which were summarized in the Journal last week, were then submitted.

The Chairman commenced his remarks by saying that, had the business been carried on during the past year in ordinary times, they would not, as shareholders of an established gas company, been satisfied with a dividend of 5 per cent. But taking into consideration the unexampled depression of all commercial enterprises—especially in South America—he thought the result of the year's working was highly satisfactory. He proceeded to speak of the severe check which the prosperity of the country had received owing to wild speculation; and said that their Company had felt it very acutely, for gas was, comparatively speaking, a luxury of the well-to-do classes, who became so impoverished by the many failures as to necessitate great economy in their gas bills. Although the Company bought coal at a cheap rate in this country, they had a heavy freight and other charges to pay, which added considerably to the cost. Then, again, the late Government made the yoke still heavier, by compelling them to pay duty on the raw material, which had been exempt since the year 1867. The Directors could not but feel that the Company were not treated in the spirit of justice and liberality which they had a right to expect. However, he did not doubt that the present Government of Uruguay, once the matter was brought anew to their notice—which it would be immediately—would take this question into serious consideration, and grant the Company their petition. Had the Directors imagined for a moment when they were discussing a reduction in the price of gas of 20 per cent., or 4s. 3d. per 1000 cubic feet, in 1887, that in a few years they would be called on to pay duty on raw materials destined for the manufacture of gas, they would have refused to make such a sacrifice. This was not a light matter, as the 20 per cent. reduction amounted to the end of 1893 to £111,166, or $522,483·80 gold. The Directors, however, had confidence in the known rectitude of Señor Borda, the President of the Republic, to deal with their complaint. Reviewing the accounts, the Chairman said the improved income for 1893 over that of 1892 was only £365. Although small, he could not help feeling that they had in this evidence, although slight, of the parting farewell of the crisis. Notwithstanding that the reduction in the public lighting was 2·02 per cent., bringing down the number of the lamps to 420, yet, as against this, they had an increase in the private consumption of precisely the same amount of 2·02 per cent., which was satisfactory; and they could only hope that the increase in the future would be a constantly progressive one. Besides writing off capital expenditure for depreciation the sum of £1288, they added £2000 to the reserve fund, increasing it to £72,000, and £500 to the insurance fund, which now stood at £12,000, and carried forward to the next account £6471. The shareholders would also note in the present accounts the amount of £8470 brought forward from 1892. The reduced expenditure for the year was £6443, which had been accomplished by skilful and economical management at Monte Video, as well as on this side. The Directors were hoping that the improvements initiated at the works would effect a considerable saving in the Company's operations in the future. Regarding the disposition of the reserve and insurance funds, now amounting conjointly to £84,000, he said that the internal bonds held by the Company were of a total amount of $250,320 nominal, or £53,259, carrying interest at the rate of 4 per cent. per annum, or £2130 a year (valued in the accounts on Dec. 31 last at £18,108, but since improved in value by £4527); £30,000 3 per cents. invested in India, Nottingham, and Metropolitan stocks (since improved in value by £1845); other property, about £10,000; coals, £7248; other materials for use, £13,590; materials for sale, £3276; and, if they added the Government debt of £5611, they obtained a total of £85,834, without taking into account the improved values indicated. Having referred to the increasing business done by the Company's dock, workshops, tug, &c., the Chairman proposed the adoption of the report and accounts.

Mr. T. C. Tatham seconded the motion.

Mr. Barber congratulated the Directors on the, comparatively speaking, successful issue of the working of the year, considering the very adverse times they had had to pass through. He wished, however, the Chairman had given the shareholders some information as to their prospects with regard to the public lighting, and as to the present position of the Company with respect to electric lighting. He also suggested that £1288 was a small sum to write off for depreciation, and inquired what the item in the balance-sheet "Other property, £10,828," represented.

Mr. Lowe, commenting upon the various items in the accounts, pointed out that during the past three years only £4672 had been written off for depreciation; while in that period they had added £18,000 to the capital expenditure. In 1886 the amount of capital expenditure was £529,000, as against £598,263 now; so that in seven years they had increased it by about £70,000. This amount was still increasing; and, although the Chairman told them they had £85,834 invested in various ways, unless some check upon this expenditure was put in force, the Company were quietly sinking into ruin. Then again, if the business in the supply of gas was decreasing, and if the Government had stopped the lighting by gas in many of the streets, and were trying to keep the electric light going, he could not see why the general outlay should be so large; and he strongly urged that something should be done with regard to this increasing expenditure. He saw that in 1886, the sales of gas, residuals, &c., produced £95,000; and the cost of manufacture and expenditure in Monte Video was only £54,000. In 1891, the sales amounted to £97,000, or an increase of £2000; while the expenditure ran up to £64,000, or an increase of £10,000. In 1892, the figures were £85,000 and £57,000; and for the past year, £77,000 and £51,000. He calculated that in 1886, the cost of manufacture and expenses in Monte Video was 58 per cent. of the receipts; in 1891, 67 or 69 per cent.; and in 1892, 64 per cent., or 6 per cent. more than in 1886. He was not at all satisfied with this.

Mr. Byfield inquired if there was any hope of the Company ever recovering the Government old account, amounting to £5611; and he expressed his regret that the bad and doubtful debts stood this year at £1637. He thought something ought to be done to obviate this.

The Chairman, in replying to the discussion, remarked that at the previous meeting he stated that he did not see there was much prospect of the Company obtaining a new concession for public lighting since one had been granted to the Electric Light Company. They now heard, however, that that Company had met with very great difficulties; and it seemed to him, from a telegram which had been received, that they were in a bad way. If this was the case, he did not despair of the Gas Company again having the public lighting in their hands. The Electric Light Company had been largely supported by the Government; but, in his opinion, the new Government would not have anything to do with the undertaking. Concerning the question of depreciation, the Directors considered the amount written off was quite sufficient, because a great part of their property was new, and in good order. With reference to the item of "other property," he explained that they had been obliged to purchase two blocks of houses, which formed part of the square in which they had some of the new works; but they let these houses to their employees, and so obtained 5 per cent. on the investment. Regarding the capital expenditure, they would not require to spend any more money for many years, as he believed they had now plant sufficient for nearly double the present business. Then as to the cost of manufacture and expenses at Monte Video, he quoted figures showing that there had been a gradual decline since 1889. In that year, the expenditure amounted to £79,737, while last year it was £51,178. The duty on coal was imposed two years ago; and it was 1s. 3d. per ton. As to the Government old account of £5611, they had received a telegram to the effect that they were prepared to deal with it; and it was proposed to pay the Company in 4 per cent. bonds.

The motion was then unanimously carried.

The Chairman proposed, and Mr. Simpson Rostron seconded, the declaration of a dividend of 10s. per share, less income-tax; making, with a similar interim payment, 5 per cent. for the year.

The proposition was agreed to.

The retiring Directors (Messrs. Dodgson and Rostron) were afterwards re-elected. The Auditors were also re-appointed; and the services of the Chairman and Directors and the officers were suitably acknowledged.

BAHIA GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Thursday, at the London Offices, 9, Queen Street Place, E.C.—Mr. Horatio Brothers in the chair.

The Secretary (Mr. T. Guyatt) read the notice convening the meeting; and the report and accounts (which were briefly referred to last week) were taken as read.

The Chairman said the shareholders would learn from the report that the Company's works had passed from their control to that of the authorities of the State of Bahia; but it was necessary, as usual, to call the shareholders together to receive and, if approved, to adopt the report and accounts for the half year ended Dec. 31 last, and to declare the dividends. The working at Bahia during the half year reflected very great credit on the management there, as the following figures would show: The amount receivable for gas was £1573 in excess of the corresponding half of 1892. The quantity of coal and cannel consumed was 21 tons less; while there was a diminution in the cost of £1048. The amount of gas made was 562,000 feet more. The production per ton of coal was 10,703 feet, of which 10,288 feet were accounted for; the unaccounted-for gas being only 4·2 per cent.—results seldom attained even in England. The expenditure (eliminating the item of exchange from the comparison) showed that the cost of working, &c., was practically the same for both half years. For the six months ending Dec. 31, 1893, it was £12,154; and for the same period of 1892, £12,192—a difference in favour of last half year of £38. The cost of coal and cannel in 1892 was £2 2s. 2d. per ton; and for the past half year it was £1 14s. 2d., or 8s. per ton less. The item of exchange in the latter period was £5690, as against £3698 in the corresponding six months of 1892; and although there was this increase of nearly £2000 in exchange, the profit on the

half year was smaller by only £581. It would, he intimated, be necessary to again call the shareholders together for the purpose of adopting the report and accounts from the date of the balance-sheet now before them to May 17, during which period the Company had supplied gas to the city. This meeting he was informed would not be held earlier than September next, and it might run on to the usual time of meeting in November; but this would entirely depend upon the success achieved in recovering the amounts due for gas supplied during the time mentioned, collecting the arrears, and settling other matters affecting the Company. The Directors, having, as they hope, been enabled then to bring the matters to a satisfactory conclusion, would submit, under the advice of the Solicitor, to a special meeting to be held immediately after the usual half-yearly meeting, a scheme of liquidation of the affairs of the Company for the approval of the shareholders, after which, if the scheme was approved, they would resign their office as Directors, which some of them had held for about 20 years. They were gratified that, during this period, the preference shareholders had received their maximum dividends, and the ordinary shareholders had, for many years, been paid from 10 to 8 per cent. The office of Director had been no sinecure, but had been attended with great anxiety and a good deal of worry in dealing with the authorities at Bahia. It was the general opinion—he might say the universal opinion—of all competent authorities that the bargain made by the Directors with the State of Bahia, after nearly three years' struggling (considering that similar works could now be constructed at far less cost, and considering also the terms of the concession, for which the present Directors were in no way responsible), was a very good one for the shareholders. From a telegram which was received on May 26 at the London office of the London and Brazilian Bank from their Manager at Bahia, the indemnity for the works and material had been paid into the Bank—viz., £100,000 in promissory notes. The first instalment would fall due on May 17 next year, and would amount to £16,000. The Directors anticipated that an instalment of £10,000 would be paid on giving possession of the works; but they were not surprised that, at the present rate of exchange, the authorities at Bahia preferred to postpone it to the end of the first year. It must, however, be said, in their justification, that no promise had been made that they would pay any instalment on taking possession. The Chairman concluded by moving the adoption of the report and accounts.

Mr. H. Finlay seconded the motion.

The Chairman and Mr. Finlay, replying to questions, stated that the promissory notes which had been deposited with the bankers were from the State of Bahia, and not from the Brazilian Government. The payment was to be in gold, extending over ten years; the first instalment being due on May 17 next. The interest to be added to the £100,000 was 6 per cent.; but, of course, the interest would be a diminishing sum. The amount which the Directors estimated the shareholders would receive included not only the interest, but the reserve fund, and money in hand.

The motion was carried unanimously.

On the proposition of the Chairman, seconded by Mr. Finlay, dividends were declared at the following rates per annum: 10 per cent. on the 10 per cent. preference shares, 7½ per cent. on the 7½ per cent. preference shares (less income-tax), and 8 per cent. on the ordinary capital (free of income-tax).

Mr. Jabez Church moved a vote of thanks to the Chairman and Directors, and remarked that the shareholders ought to be very grateful to them for the great trouble they had taken in managing their affairs during the recent very anxious time.

Mr. W. Hughes seconded the motion, which was heartily agreed to.

The Chairman, having responded, proposed a vote of thanks to the officers.

The Secretary returned thanks; and the proceedings terminated.

The Charges for Gas in the Brentford Gas Company's District.—At the meeting of the Twickenham Local Board on the 24th ult., a letter was read from the Brentford Gas Company, intimating that the Directors had decided to reduce the price of gas from Midsummer to 2s. 9d. per 1000 cubic feet for public lamps, and to 3s. 1d. for private consumption. A communication was also read from Mr. Hugh R. Peake, the Clerk to the Heston and Isleworth Local Board, in regard to a proposed combination of local authorities, with a view of obtaining a reduction in the price of gas used for public purposes. It was stated that the various authorities in the radius supplied by the Brentford Company used gas to the extent of £10,000 annually. It was resolved that two delegates should attend a conference on the subject; and the letter was referred to the Lighting Committee.

Staffordshire Potteries Water Company.—The annual meeting of this Company was held last Wednesday. The statement of accounts which was submitted for the year ending March 25 showed that the water revenue amounted to £35,567, against £34,242 for the corresponding period of 1893. The available balance on the year's profit and loss account was £16,957, which, with the addition of £2307 brought forward from previous accounts, made a total of £19,264. This, after deducting the interim dividend paid in December last, left a balance of £10,564, out of which the Directors recommended a dividend at the rate of 6 per cent. per annum, free of income-tax; making, with the interim payment, 6 per cent. for the year, and leaving a balance of £1864 to be carried forward. The Directors stated in their report that during the past year the Hatton works had been in general use for the supply of the district. The new covered service reservoir at Goldenhill had been completed; and the distribution of water in the locality had been greatly improved. In moving the adoption of the report, the Chairman (Mr. J. F. Wileman) said that, to make themselves masters of the Hatton resources, they had taken steps to duplicate the mains from the pumps to the reservoirs; and when the work was completed, they would have absolute control of the situation, and have a splendid pumping-station. Though there was a diminished credit balance, the Company had fully earned their 6 per cent. dividend; and he thought it would be admitted that the business was of a solid, permanent, and paying character. The motion was unanimously carried.

BIRMINGHAM CORPORATION WATER SUPPLY.

The Committee's Annual Report and Accounts.

The annual report of the Birmingham Corporation Water Committee contains some information respecting the progress made with the preliminary works in connection with the Elan undertaking. The Committee suggest that, in their opinion, the time has arrived when a personal inspection of the works should be made by the Council. The first section of the railway will shortly be completed; considerable progress has been made with the erection of the first of the two villages for the workmen; and most of the buildings for administrative purposes are either finished or in a forward state. The opening of the quarry for the supply of stone for the large dam at Caban Coch has also made some progress. A good idea can now be formed of the arrangements which are necessary for carrying out the work; and the Water Committee think that a local acquaintance with the site of the works and their surroundings will enable the Council better to understand the reports submitted to them from time to time, and to come to a more correct judgment on matters requiring their decision than would otherwise be the case. The total areas purchased are as follows: Ancient freeholds, 5215 acres; common and exclusive rights, 20,109 acres; minerals or mining rights, 5879 acres; and manorial rights, 31,080 acres. A contract has been entered into with Messrs. Morrison and Mason, Limited, of Glasgow, for the section of the aqueduct from Dolau to Knighton. The total length of the aqueduct covered by this contract is 10½ miles, of which 6¾ miles is tunnel. The amount of the contract is £284,821, on the basis of the tunnels being lined throughout. The time allowed for its completion is five years; but for certain of the works, the time is limited to a shorter period. The Committee also submit the accounts for the year ended March 31 last. The water-rents have increased by £32,733, which is mainly due to the operation of the revised scale of water-rents, which came into force on April 1, 1893. The profit and loss account shows that the profit for the year was £26,923. Deducting the loss of £6595 brought forward from the previous year, leaves £20,327, which has been transferred to the special fund for the new Welsh scheme. The capital account under the Water Acts of 1875 and 1879 shows a total expenditure of £2,093,536. Under the Act of 1892, the capital expenditure amounts to £350,366. The revenue of the past year was £178,116—including from water-rents, £175,916; from service laying, £1438; rents of land and cottages, £454; fishing subscriptions and tickets, £288; and transfer fees, £17. The total number of houses supplied is 128,573, as compared with 125,593 in the previous year. The baths (for which an annual charge is made) number 6438, as compared with 5752. There are also 9436 businesses and other premises receiving unmeasured supplies, as against 9454. The quantity of water supplied in the year was 5996 million gallons, or a daily average of 16·472 million gallons.

STOREAGE CAPACITY IN LAKES AND RESERVOIRS.

At a recent Meeting of the Cornell University Association of Civil Engineers, a paper on this subject was read by Mr. E. H. Hooker, from which we make the following extracts.

In general, reservoirs have two duties to perform—first, to make possible, during seasons of flood and drought alike, the delivery of a regular supply of water at or near the place of distribution; and, secondly, to provide for the daily and hourly fluctuations of demand. Storeage may therefore be defined as the accumulation of water in a reservoir in times of plenty to tide over the periods of drought; and its object is to ensure a uniform "conduit draught" for any town depending on the watershed for its source of supply. For determinations of storeage, the following method was formerly commonly adopted: Assume a definite value for the storeage volume; consider the reservoir full at the beginning of the year; to this volume add the inflow, and subtract the outflow for each month in turn of an average year, and thus determine the storeage at the end of every month. If, in any case, the result shows a deficiency, the assumed storeage was too small, and a recomputation must be made with a new initial storeage. This method was an advance over mere guesswork, or the direct application of experience gained on one watershed to the solution of storeage problems on another, with no account taken of determining conditions totally different. Yet it was a cumbersome and indirect solution; and the results are misleading.

Since the purpose of the storeage reservoir is to provide for the fluctuations of supply and demand during an indefinitely long period, it is not sufficient to take an average year for the determining condition, as the required storeage is a function not only of the absolute values of supply and demand, but also of the relative arrangement of these values. The late Mr. Hawksley took a step in the right direction in putting forth his empirical formula based on the conditions obtaining during a period of three consecutive dry years. His formula is $Z = 1000 \div \sqrt{R}$; where Z is the number of days' storeage required, and R is the average rainfall in inches during the three consecutive dry years; the average rainfall for a dry year being assumed at five-sixths of that for an ordinary year. Also the volume stored in one day is $T = B + C + V - D$; where B is the demand of the town, C the compensation to the stream, V the evaporation from the reservoir, and D the dry-weather flow into the reservoir. Here all quantities are estimated for 24 hours. $Z = 100$ to 250 days for England and English conditions. These formulas would only be applicable where, as in England, the compensation to the stream is fixed by law at one-third of the available supply. The main criticism to be made on Mr. Hawksley's method is that it covers only a single period of three dry years. It is not safe to rely on a single period of drought; for it may happen that a long series of alternate periods of plenty and of drought may follow each other. Perhaps no single drought may have excessive overweight, and yet the sum total of these deficiencies may be very great. As an actual fact, applying Mr. Hawksley's rule to the storeage provided in Liverpool, Manchester, Dublin, and Edinburgh, his results fall short of the actual by from 20 to 30 per cent

The first really satisfactory method of determining the storeage required was the graphic one proposed by Herr W. Rippl, and described by him in a paper read before the Austrian Society of Civil Engineers. As all subsequent solutions have been more or less directly based on this paper, it may be well to look into his method somewhat in detail. On an axis of abscissæ the months are laid off for each year of the period under consideration, and the demand of the town in cubic feet for each month in turn plotted as ordinates. A slightly undulating curve drawn through the points so plotted gives the demand curve. In the same way the supply curve is plotted, and represents available rainfall from the watershed. Whenever the supply curve rises above the demand curve, we have a surplus on hand; and when the latter curve rises above, a deficiency is shown for the period indicated. From such a diagram the surplus or deficiency for each month can be scaled off, and used in turn in the construction of a mass curve. Here again abscissæ represent months and years of the period involved; but the ordinate at each month represents the algebraic sum of all surpluses and deficiencies from the beginning of the period up to the time then ending. This mass curve reveals the following properties: The surplus or deficiency, during the interval between any two points on the axis of abscissæ is represented by the difference of the corresponding ordinates. An ascending part of the curve shows an increasing reservoir supply, and a descending part a decreasing supply; while crests and hollows show instants when demand and supply are balanced.

Another graphic solution of the problem, presented before the Liverpool Engineering Society, is in substance as follows: Determine the monthly increments of both supply and demand in cubic feet of water. Add these two quantities, and form two series, giving the total supply and the total demand up to the end of each month from the commencement of the period. Plot these series as ordinates, using months as abscissæ, so that each ordinate will represent the total demand or supply up to the time then ending. The curves through these points will have the following properties: The inclination of the curve to the axis of x marks the rate of increase or decrease of the quantity represented. When the supply curve is inclined, most storeage may take place; when the demand curve is inclined, most storeage is being drawn down. A line should be drawn parallel to the demand curve, and touching the supply curve at the points of inflection. The total amount of loss or gain at any point is the difference between the ordinates of the supply curve and those of the line parallel to the demand curve. The maximum value of this ordinate is the storeage capacity required.

In Mr. Fitzgerald's study of the Sudbury River and Lake Cochituate watersheds, he has followed the general method proposed by Rippl, and has tabulated some interesting information. The data used cover the period from 1875 to 1890, and include two years of unparalleled drought following each other closely. Thus we have not only a long period covered, but one including the extremes of condition. One table gives the storeage required in millions of gallons for different daily abstractions of from 100,000 to 900,000 gallons per square mile of watershed for varying percentages of water surface. Its main value, as suggested in Mr. Fitzgerald's paper, is that it enables one to determine the probable storeage required in different reservoirs when they are scattered over the watershed, and each has a different relative amount of water surface tributary to it. Another table gives the period during which the water surface will stand below high-water mark for different quantities, from 100,000 to 900,000 gallons, drawn per day per square mile of watershed. This table is of value as showing the probable growth of vegetation on the exposed bottom, which when flooded will add to the impurity of the water. In the same paper the author proposes the following method of computing storeage, which will be seen to differ but little from Rippl's method: He plots the flow of the river, and assumes a draught-line. The algebraic sum of the ordinates from the flow-line to the draught-line will give the required storeage for the period. The proper draught-line to consume the full capacity may be obtained after one trial by simple proportion, and the storeage computed again as before.

Mr. F. P. Stearns, in his report to the Massachusetts State Board of Health, has presented a table in which a valuable refinement is introduced. Mr. Fitzgerald has assumed that the evaporation from water surfaces just equals the rainfall on them. Mr. Stearns has tabulated the storeage required to make available different volumes of water per square mile, of land surface only, per day from watersheds with different percentages of water surface, where a correction is made for the effects of evaporation and rainfall on the varying percentages of surface. A still further refinement might well be introduced, which would take into account the varying area of water surface as the reservoir surface rises and falls. We sometimes find ourselves neglecting this factor as of little weight in the ordinary problems in hydraulics; but its influence on storeage cannot be ignored. The available supply from a given watershed must be the total rainfall on the surface, less the amount lost by evaporation and other losses, such as percolation, absorption by vegetation, &c. These latter losses in a well-constructed reservoir are of little importance as compared with the evaporation, which is so great that in some discussions of this problem it is considered as wholly taking up the rainfall on the reservoir surface proper. The evaporation from a water surface is much greater than that from the ground, and its value, for the climate of Boston, is seen from the following figures obtained from Mr. Fitzgerald's experiments on the Chestnut Hill reservoir. These depths are in inches, and represent the means of the values for each month, covering the period from 1875 to 1890. The depths were as follows: January, 0·96; February, 1·05; March, 1·70; April, 2·97; May, 4·46; June, 5·54; July, 5·98; August, 5·50; September, 4·12; October, 3·16; November, 2·25; December, 1·51—total, 39·20 inches. The values are usually obtained by plotting the observations for each year, and through them drawing the nearest regular curve possible. The values for each month are then scaled from the curve.

To attempt to discuss evaporation, available rainfall, and storeage, in the limits of this paper, would be at once recognized as impossible; and hence we shall only glance at evaporation and rainfall long enough to see what units are to be used to subserve the purposes of our investigation, and where we are to look for information on these subjects. The United States Weather Bureau keeps records of rainfall which are usually accessible to the engineer, though more or less unreliable for his purposes. In many cases observations are made from the tops of tall buildings, where the temperature is different from that of the surface elevations with which the engineer deals. Again, the angle at which the rain falls may materially affect the size of the rain-gauge aperture perpendicular to the direction of the rain-drops. The most reliable results are usually obtained where the rainfall records are kept, under the supervision of the engineer, directly on the watershed itself. These records should give the depth in inches of rainfall for each month of the year, carefully including snow, which may be reduced to water. These depths in feet multiplied into the area of the watershed will give the total rainfall in cubic feet for each month of the year or years covering the period of observation. Observations of this character have been collated by Mr. Fitzgerald for the Boston Water-Works, and by Mr. Alphonse Fteley for the Croton watershed; and they may be obtained from the Philadelphia Water-Works reports for the watersheds of the Tohicon, Neshaminy, and Perkiomen Rivers, which furnish Philadelphia's supply.

As to the proportion of this rainfall which can be collected in the reservoir for storeage purposes, we can say only a word, although it is a problem on which a treatise might be written. In general, the method of determining the percentages available is made by gauging the flow of the stream for certain known depths of rainfall, and deducing a percentage of collection for each month of the period considered. The percentages of water flowing off will, of course, be largely affected by the character and configuration of the watershed. A steep, rocky drainage area would be called a "quick" watershed, and would yield large percentages; while more sloping and better cultivated land would yield small proportions. Not only is the off-flow determined by the character of the surface, but is also a function of the season of the year and the temperature. In winter, when the ground is frozen, a larger percentage will flow off than in summer; and in some cases—notably in the month of March—we may even have the apparent paradox of a collection of 200 per cent. for a given rainfall. This is easily understood when it is remembered that we are likely to have in the spring a storeage of rainfall on hand, in the form of snow, which is the accumulation of previous months, but which melts and runs off during March—thus raising its percentage of off-flow. As is seen at once, no general percentages can be laid down; and the engineer cannot be too strongly cautioned, in all these determinations, against using results obtained from one set of conditions, and applying them to another case where the conditions are wholly dissimilar.

Having thus, in a general way, arranged the data, determined the depths of rainfall, inches of depth collected for each month, area of watershed, area of water surface, depths of evaporation for each month, and amount of compensation water required, and having assumed as well a regular quantity drawn off by the conduits, we may apply Rippl's graphic method directly, and determine the amount of storeage required. The storeage problem usually presents itself to the hydraulic engineer in this form: Given a certain possible amount of storeage in the lake or reservoir, how much water can we expect to make available for supply purposes without causing excessive fluctuations in the water surface? We may make a computation for a series of values of conduit draught, and plot the resulting fluctuations in the reservoir service. That conduit draught will then be chosen of which the resulting curve does not fluctuate beyond the limits fixed by the natural conditions inherent in the reservoir. These natural conditions will vary with the situation of the reservoir, and must be studied independently in each case. If the reservoir is a lake surrounded by cottages, then the fluctuations of the lake are likely to be limited by the elevation of boat-houses, lawns, and houses above the former water surface; while the lengths of periods during which the lake may be drawn down will be limited by the rapidity with which the uncovered shores become overgrown with marshy vegetation. Such growths are among the most active of the contaminating agents, and afford strong argument against excessive fluctuations in the water surface.

New Joint-Stock Companies.—Among the new joint-stock companies recently registered are the following: Binns Gas and Oil Engine Company, Limited, with a capital of £2000, in £1 shares, to acquire the engineering business hitherto carried on by Messrs. Binns and Co., at Halifax, Yorkshire. The Cold Process Gas (Foreign and Colonial Patents) Syndicate, Limited, with a capital of £500, in £1 shares, to acquire any patents, inventions, &c., relating to the production and distribution of gas, and to develop and turn them to account; and, with a view thereto, to enter into an agreement with Mr. J. H. W. Stringfellow.

The Hebden Bridge Gas Bill.—On Monday last week, the Bill of the Hebden Bridge Gas Company, which was under consideration by Sir James Kitson's Committee in the House of Commons before Whitsuntide, came up again for the adjustment of clauses, especially one embodying the terms upon which the Company's undertaking is to be acquired by the Local Board. These are 27 years' purchase of the income; and a provisional agreement has been entered into between the parties. The purchase cannot, however, be completed until after the Local Board have obtained parliamentary sanction thereto by an Act to be applied for next session.

The Public Lighting of Newcastle.—Attention is now being seriously given to this important subject (says the *Newcastle Chronicle*) by the Newcastle authorities. The cost of lighting the city is said to be very great, despite the fact that, very unwisely, a portion of the lamps are now left unlighted at this part of the season. It is estimated that the Corporation pay from £13,000 to £14,000 per annum for gas lighting; while the cost of each of the large electric lamps is about £42 a year. It is thought that the Corporation should, if possible, take the public lighting of the city, at any rate, into their own hands; and a Special Committee have been sitting to consider the matter. Nothing definite has been done, save that a report has been ordered on the subject; but it is likely that the public will hear more of the scheme. It may be impossible, adds our contemporary, for the Municipality to buy up the rights and plant of the Gas Company; but it is believed that the city can be effectually lighted by means of electricity, and with advantage compared with the present cost.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners had little business of public interest before them at their meeting on Monday. Perhaps the item of most importance to your readers was a return by the Engineers as to the cost of meter repairing, which, I take it, brings out some interesting facts as to the comparative cost of the upkeep of wet and dry meters. The return embraced the period from Jan. 1, 1891, to Dec. 31, 1893. In the Edinburgh works, it was shown, 9657 meters had been repaired, at a total cost of £5343, or an average of 11s. 0·8d. per meter. The total lights served by these meters was 41,110; and the average cost per light was 2s. 7·19d. In the Leith works 6640 meters were repaired, at a total cost of £2559. The number of lights served by the meters was 21,167; and the average cost per light was 2s. 5·01d. The proportions of wet to dry meters repaired were: In Edinburgh, 707 to 8950; and in Leith, 4624 to 2016. This fully accounted for the difference in cost of repairs per meter. The only other business of interest was a proposal to institute a superannuation fund for officials and workmen, which is, however, to come up again.

The accounts of the Dundee Gas Commission, for the year ending April 30, were laid before the Finance Committee of the Commission yesterday. They show that the revenue estimated a year ago was £82,246, and that the actual receipts amounted to £78,061; the income thus falling short of the estimate by £4185. The expenditure was estimated at £81,146; and the actual disbursements amounted to £77,660—a difference of £3485. The details of the revenue are: From gas and meter rents, £71,771; chemical products, £5613; coke, £101; coal-waggon revenue, £141; gas-stove rental, £108; horses and keep, £69; transfer fees (debenture stock), 17s. 6d.; and balance from last year, £253. The expenditure includes the following items: Coal, £36,101; purifying, £917; main-pipe repairs, £713; service-pipe repairs, £551; repairs of buildings, £1190; gas apparatus, tools, &c., £1232; retorts and setting, £2109; meter repairs, £1631; fuel, £554; refuse, £950; interest account, £6426; expense of loans, £100; annuities, £7356; assessments, £4934; rents, £357; salaries, £2815; stationery, £218; general expenses, £594; coal analyses, £405; sinking fund, £7500; and contingent fund, £1000. During the year £1453 was expended on the capital account, raising it to £190,646. The quantity of gas delivered was 475,750,900 cubic feet, of which 8·143 per cent. was unaccounted for. The output of gas shows a great decrease, arising from the dulness of trade in the city; most of the mills having worked short time during the winter. Last year the output was 502,954,600 cubic feet, so that there has been a decrease of 27,203,700 cubic feet. The price of gas was 3s. 4d. per 1000 cubic feet, as against 3s. 9d. in the year preceding; and both causes account for the revenue from gas falling from £84,346 to £71,771. For the current year, it is estimated that there will be an output of 477 million cubic feet of gas. In the electricity department, the income was £2649; and the expenditure, £4532. For the current year, it is estimated that the income will be £3320, and the expenditure £5326; leaving a deficit of £2042, which is to be made up out of the balance on the gas account. It is proposed to retain the price of gas at 3s. 4d. per 1000 cubic feet, and the price of electricity at 5d. per unit.

The accounts of the Perth Gas Commission have also been issued during this week. The total revenue was £19,297, as compared with £19,545 a year ago. This is quite a satisfactory result, considering that the price of gas in the city has been reduced from 4s. to 3s. 9d. per 1000 cubic feet. The expenditure amounted to £19,229, which leaves a credit balance of £68. Coal cost £5860; and oil for gas making, £871. A year ago the coal and lime account was reported to have been £8000; so that the oil process would seem to have led to a considerable reduction in the coal used. The oil-gas plant cost £1067; and the whole of it has been paid out of last year's revenue. The output of gas was 96 million cubic feet, as against 97 millions the preceding year, and 92 millions two years ago. It thus appears that the introduction of the higher illuminating power gas derived from oil has not told, to any great extent, as some expected it would, on the quantity consumed. Coal has been contracted for at 12s. 6½d. per ton, or 1s. 6½d. more than last year. Although this means a higher expenditure, the Commissioners propose to lower the price of gas in the Scone suburb from 4s. 7d. to 4s. 2d. per 1000 cubic feet, and to reduce the charge for meters all over by one-third. The price of gas is to be retained at 3s. 9d. within the city. It is also proposed to expend £955 upon the redemption of annuities.

Another instance of the incapacity of the electric light to carry far in foggy weather is given by the wreck of the Dundee steamship *Jasper* upon the May Island on the night of April 16. The vessel was carried out of her course by currents, unknown to the captain, who had, on account of fog, no means of verifying his position; and with only a couple of minutes' notice, the island was struck 500 yards from the lighthouse. Even after the crew got ashore the light was not visible. It is a very powerful electric light, erected about eight years ago, at a cost of £60,000; and in clear weather it is visible for a distance of 20 miles. A fisherman who gave evidence at a Board of Trade inquiry this week, stated that when he was about a mile from the island he could not see the light, although he could see the light on the Fifeshire coast, an oil-light, which was 2½ miles off.

Yesterday there was heard and disposed of by Lords Wellwood and Kyllachy in Edinburgh, an appeal with regard to the valuation of ammonia works in the Shotts Iron-Works, which, it will be remembered, was also before the Court last year. The Furnace Gases Company, Limited, of Glasgow, were the appellants. They occupy a piece of ground in the Shotts Company's works, at a yearly rent of £40 and a royalty. This land was let in 1890 by the Shotts Iron Company to Messrs. R. and J. Dempster, of Newton Heath, Manchester, who transferred their rights to the Furnace Gases Company. The agreement with Messrs. Dempster required them to provide plant for the treatment of the furnace gases, and to pay, besides the rent, a royalty of 1s. per ton of coal treated in the furnaces, under deduction of a discount of £10 every three months. The ammonia works which have been erected have cost £48,000. The assessor assessed them at £2400. This was objected to by the Company; and when the case came before the County Valuation Committee, the Secretary of the Company stated, in evidence, that the production in the works, per year, was 772 tons of ammonia, 445,450 gallons of oil, and 4506 tons of pitch. The Company maintained that they being tenants of land only, with an obligation to build works and to remove them at the end of the lease, or, in the option of the Shotts Iron Company, to sell them to that Company at a valuation, the works should not be assessed at all. The ground for this contention lies in the legal decision, given a number of years ago, that where a real rent was paid, and the proprietor derived no consideration other than rent, any buildings which a tenant might erect, if they were subject to removal by the tenant, were not assessable. In this case, the Assessor maintained that the royalty was a consideration other than the rent; but to that the reply was that the royalty was paid, not for the land which was occupied, but for the right to treat the gases, and that right, not being heritage, could not be assessed. The County Valuation Committee upheld the Assessor's valuation; and the case was taken before the Supreme Court in Edinburgh, where their Lordships, as they did last year, reversed the decision of the County Committee, and directed that the works should be assessed at £40, the amount of the rent paid. The decision is, of course, upon strictly legal lines; but it leads to the absurd result that property which it is admitted cost £48,000 is absolutely unassessed.

A deputation from the Edinburgh and Leith Gas Commissioners visited Perth on Thursday, to see the oil-gas plant in use in the gas-works there. Mr. Whimster and his Assistant (Mr. Easson) were, of course, most obliging in showing all that was to be seen. The Edinburgh and Leith Commissioners had the Peebles process recommended to them by their Engineers (Mr. Mitchell and Mr. Linton) more than a year ago; and they have had the subject before them since, but have taken no action upon it. They have been waiting to see what other processes might be able to do; and in the meantime other works have got in front of them in the making of gas from oil.

A beautiful instance of the friendly relations which sometimes exist between gas companies and local authorities is furnished by the proceedings at Bo'ness at the end of last week, when the local Gas Company celebrated their Jubilee. The Company entertained the Police Commissioners, town officials, and other public men to dinner. Ex-Provost Thomson presided; and in the course of the evening, Provost Ballantine, on behalf of the shareholders of the Company, presented Mr. Thomson with his portrait in oil, in recognition of his services to the Company in the capacity of Chairman, during the past 25 years.

A curious incident is reported from Glasgow. On Tuesday afternoon a waiter in a hotel went to his room, and two hours later was found dead in bed. The gas in the bedroom was turned full on; and in announcing the death, one newspaper says: "It is supposed that the deceased had been suffocated by the poisonous fumes." Surely two hours' exposure to gas fumes is not sufficient to cause death.

The Leven (Fife) Gas Company pay their usual dividend of 10 per cent. for the past year, and have added £480 to the reserve fund.

With reference to the extensions at the Ardrossan Gas-Works, mentioned by our correspondent last week, we learn that they consist mainly of a new retort-bench, and the adoption of the Peebles oil-gas enriching process. The work is being carried out under the superintendence of Mr. A. Gilliespie, of Glasgow.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June 2.*

Sulphate of Ammonia.—Prices have advanced to £14, and are, judging by appearances, likely to remain there. The quantities on the market are extremely small; and the demand is getting keener, while the gas make is rapidly falling off, and the prospective supplies for the summer, from the present standpoint, seem insignificant. It is already difficult to secure contracts for delivery between now and September; and inquiries are on the increase. It is stated that the bulk of the sulphate has been purchased for speculative account; but second-hand parcels have recently become scarce—a fact which indicates that the sulphate bought will all be wanted, and will not appear on the market again. A premium on spot values is offered for summer delivery; and even October-March contracts cannot now be obtained below current values. It is stated that up to £13 17s. 6d. has been paid for the latter delivery, which is a satisfactory indication that buyers have every confidence in the future. Consumers intimate that the prevalence of high prices will check the demand; but, in the absence of substitutes, no importance is to be attached to this statement. Nitrate is a little firmer.

LONDON, *June 2.*

Tar Products.—Benzols are very dull indeed; and at the moment there do not appear to be any buyers of 90's who would pay more than 1s. per gallon at the best ports. At this price, it is far and away the cheapest enricher for gas that could be used, especially if it was employed in the crude form—thus saving the 2d. or 3d. per gallon which it costs the refiners to prepare it for the market. Mr. Bell's paper, in the last issue of the JOURNAL (p. 1006), has created a good deal of comment in the direction of the use of benzol for fortifying gas. If it were not that pitch is of better value, and looks like maintaining the higher standard of value, the low prices of benzol and the other products would reflect themselves seriously in the value of tar. There is a good deal doing in carbolic acid products; and the shortened supply of this article, and the absence of stocks, either in makers' or consumers' hands, will probably bring about an advance in price. Anthracene is considered strong and well held; while the other products are distinctly flat. To-day's values may be taken as follows: Tar, 13s. to 17s. Pitch, 28s. 6d. Benzols, 90's, 1s.; 50's, 1s. 3d. Solvent naphtha, 1s. 2d. Creosote, 1¼d. Creosote salts, 20s. Toluol, 1s. 6d.;

Cresylic acid, 1s. Crude benzol naphtha, 30 per cent., 5½d. Carbolic acid, 60's, 1s. 8½d. Anthracene, "A," 1s. 2d.; "B," 10½d.

Sulphate of Ammonia is in excellent demand; any parcels offering being taken up at once, at prices which have ranged during the week from £13 17s. 6d. to £14 2s. 6d., less 3½ per cent., according to port and conditions of shipment. There appears to be a much less supply of sulphate, due probably to the lessened production of gas from coal; while the increasing value of nitrate of soda is doubtless influencing the price of sulphate. Gas liquor is offered at 10s. to 12s. a ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With the commencement of the present month, there has been no change in either the official list rates of the Lancashire Coal Sales Association, or in those of the leading Manchester colliery firms; but in the open market there is continued undercutting by outside colliery owners, and coal from other districts is being pushed here at extremely low figures. Pits are in very few cases working more than three to four days per week, and stocks still accumulate. With regard to gas coal, a few of the smaller contracts have been settled recently; and so far as rates can be ascertained, they appear to be about 6d. up to 1s. above the minimum prices which were taken last year. Where 1s. more has been got, however, it has been under very special circumstances. As previously intimated, the attempt made by the Lancashire and Yorkshire coalowners to hold out for an advance of not less than 1s. per ton upon the minimum prices which were obtained last year, is not being adhered to in all cases; and a special arrangement has been made for tenders to be sent in for the supply of the Manchester Corporation Gas-Works, at prices based upon an advance of 6d. above last year. Further conferences have been held during the past week; and a meeting of representatives of Lancashire and Yorkshire gas-coal collieries was held last Tuesday at Sheffield. There has scarcely yet been sufficient actual business done to really establish prices for gas coal for the ensuing season; but quotations seem to be on the basis of 8s. to 8s. 6d. for ordinary screened, up to 9s. 6d. for best Arley screened coals at the pit mouth. With regard to other descriptions of round coal, pit prices remain at about 11s. to 11s. 6d. for best Wigan Arley; 10s. to 10s. 6d. for Pemberton four-feet and seconds Arley; with common round coal ranging from about 7s. 6d. for steam and forge qualities, up to 8s. and 8s. 6d. for common house-fire descriptions. For shipment, the official quotations remain at 8s. 6d. to 9s., according to quality, for steam coal delivered at the ports on the Mersey. But outside sellers are taking under these figures; and coal from other districts is in some cases being offered at almost any price that it will fetch. Engine classes of fuel are in fair demand; but there are ample supplies in the market, and prices can scarcely be said to be firm at the full rates recently ruling. At the pit mouth, good ordinary descriptions of slack can be readily bought at 5s. to 5s. 6d., with special sorts at about 6s. 6d.; burgy, 6s. 6d. to 7s.; and through-and-through coal, 6s. 9d. to 7s. 3d. per ton.

Northern Coal Trade.—With the anticipation of early troubles in the Scottish coal trade, there is a fuller demand for coal in the North of England, as some consumers desire to increase stocks. The rate of freight for steamers, too, may increase; and thus there is a desire to take advantage of the present rates, and send more coal forward on contract. The collieries are a little better employed; but the gas and household pits are making only very short time. Best Northumbrian steam coal is quoted at from 9s. 9d. to 10s. per ton f.o.b.; second qualities being 9s. to 9s. 6d.; and steam smalls, 4s. 6d. to 4s. 9d., with a good demand for the latter kind. There is no alteration in the price of manufacturing coals; but though there is generally a large quantity offering, yet of one or two kinds there is some scarcity. Gas coals are unaltered in price; the combination rate being from 7s. 3d. to 7s. 6d. per ton f.o.b. There is no alteration in the price of smithy coal. Coke for blast furnaces is in good request for local consumption, and a full supply is being sent to the west coast; but the exports are still lower than they were. The price of best Durham coke is from 13s. to 14s. per ton f.o.b. There is no change in the gas coke trade; but with an increased export, the stocks are now locally very small. The price is not altered this week.

Scotch Coal Trade.—The question before coal owners in Scotland just now is how the miners are to act, following upon the decision of the Carlisle conference of the Federation directing the men to resist the reduction of 1s. per day which has now been enforced. The decision was not a very clear one, for it merely directed the men to ask back the reduction, and declared that the Federation were favourable to a levy for the support of the men. This is being interpreted by the miners as an invitation to strike; and they are about to ballot upon the question of whether the 1s. is to be restored to them, or they should strike. The Federation neither directed a strike, nor bound themselves to support the men if they came out. This is looked upon by some of the coalowners as indicating that the leaders of the men are not very sanguine of the results of a strike, and as lending probability to the view that the men will not come out. The situation is complicated by the circumstance that, since the reduction came into force, the demand for Scotch coal has improved. If the improvement should continue, there is therefore a probability of a portion at least of the reduction being offered back. Such a result would effectually kill any strike proposal; and in the meantime it looks the most likely course to be followed. The trade has been very little affected by the action of the men. Steam coal is dull. Ell is in good demand; and main has improved. Splint is also going off well. The prices quoted are: Main, 6s. 10d.; ell, 8s. 3d. to 8s. 6d.; splint, 7s. 6d. to 7s. 9d.; and steam, 9s. per ton f.o.b. Glasgow—all the same as last week. The shipments amounted to 158,949 tons—an increase of 6154 tons upon the preceding week, and of 13,937 tons on the corresponding week of last year. For the year to date, the total shipments have amounted to 2,897,346 tons—an increase over the quantity in the corresponding period of last year of 353,518 tons.

Reduction in the Price of Gas at Carrickfergus.—At the last monthly meeting of the Directors of the Carrickfergus Gas Company, Limited, they decided on reducing the price of gas from 5s. 10d. to 5s. 5d. per 1000 cubic feet, to take effect from the 31st ult.

Colne Gas Supply.—The Colne Local Board have received sanction from the Local Government Board to borrow £10,300, for gas-works extensions; the period of repayment being extended over 30 years. The profits on the undertaking last year aggregated £1400, as against an estimated £1100; but the price of gas was advanced 6d. per 1000 cubic feet in November, and continued until the end of the year. This course was adopted by reason of the extra expenditure incurred during the stoppage in the coal trade.

Issue of Additional Stock of the Shrewsbury Gas Company.—At their meeting last Wednesday, the Directors of the Shrewsbury Gas Company opened tenders for the £5000 stock advertised in the JOURNAL for the 15th ult. In all, £13,020 of stock was applied for, at prices varying from £170 to £175; but only £5000 was allotted. Parties tendering above £172 received allotments in full; those at £172, *pro rata*; and those who were below £172 were unsuccessful. The average price realized was £172 3s. 6d. per £100. The stock pays 7½ per cent., and is not under the sliding-scale; so it has sold well.

South Yorkshire Collieries and Gas Coal Contracts.—According to local reports, the sellers of coal in South Yorkshire are in a better position with regard to gas coal than they were a year ago, when contract prices went down about 1s. 6d. a ton in consequence of the abandonment of their position by a few owners. Owing to the demand for household fuel, coal which might be sold for gas making is from 8s. to 8s. 9d. per ton; and the trade is found fairly steady. It is stated that The Gaslight and Coke Company paid an advance of from 6d. to 1s. a ton in Northumberland a month or two ago; and a similar advance is understood to have been obtained on contracts placed by the Company in South Yorkshire within the last week or two. An effort is to be made to maintain this generally.

Exhibitions of Gas Appliances.—Messrs. Fletcher, Russell, and Co. are holding a representative exhibition of their numerous types of gas cooking-ranges, fires, and other domestic appliances, at the Church Institute, Leeds; and twice daily Mrs. H. M. Young practically illustrates the usefulness of the cooking-ranges.——The Davis Gas-Stove Company, Limited, held last week an exhibition of their appliances in the Village Hall, New Southgate, Miss A. A. Hunt giving lectures on cookery.——Messrs. W. Parkinson and Co. held a very successful exhibition in the New Hall, Cannock, from the 28th to the 30th ult.; also one in the Town Hall, Rugeley, on the 31st ult. and the 1st and 2nd inst. Miss Edith Sanderson lectured to large audiences, and gave practical demonstrations on cookery, at both places. This week they are holding an exhibition in the Victoria Rooms, Oswestry, with Miss Sanderson's co-operation as lecturer.

Accident to Mr. John Tindall.—An accident, which fortunately has not resulted in any very grave consequences, occurred to Mr. John Tindall, of Walsall, during the inspection of the Cheltenham Gas-Works last Thursday by the members of the Midland Association of Gas Managers. In stepping to the ground off a charging-stage in the retort-house, Mr. Tindall trod on a retort-lid, which turned over, and threw him heavily to the ground, dislocating his right shoulder. He was at once removed to the Cheltenham Hospital for treatment, but was afterwards able to return to Walsall by rail. A letter received yesterday states that the patient was progressing very satisfactorily—thanks, in a great measure, to the manner in which the injury was so promptly and efficiently attended to at Cheltenham. Mr. Tindall desires us to convey his thanks to the many friends who have since written expressing their sympathy with him, and to whom he is at present unable personally to write.

The Somerset Miners and the Coal Trade of the District.—Owing to the slackness of work at the Writhlington Collieries, the men (who had come down to two days per week) recently had an interview with the Directors, and arranged to offer the Company a reduction of 10 per cent. in wages, with the view of assisting them in meeting the present difficulty, and preventing the discharge of hands. The offer was accepted; and the result will be that some hundreds of men and boys, who would but for it have been thrown out of work, will be retained. The action of the Writhlington men was considered at a meeting of miners held at Radstock last Thursday, when a resolution was submitted to the effect that, seeing the critical position in which the employers had been placed by this decision, the reduced terms should be accepted by the Radstock men. An amendment was, however, brought forward in direct opposition to this proposal, and carried by acclamation—only four votes being recorded for it.

Kendal Corporation Gas and Water Bill.—A special meeting of the shareholders of the Kendal Gas and Water Company was held yesterday week, for the consideration of the Bill to authorize the transfer of the Company's property to the Corporation. The Chairman (Mr. W. D. Crewdson) presided, and said the Bill had passed through the House of Lords; but no material alteration had been made as between the Kendal Corporation and the shareholders with regard to the conclusions at which they arrived when they sanctioned the provisional contract with the Corporation on Nov. 10 last. The basis of the transaction was this: The Company would sell, and the Corporation would buy, the whole business as a going concern; that the Corporation should take over practically all the Company's assets and liabilities, including the debenture debt, and having done so they should pay for division among the shareholders the sum of £80,000, which would produce £21 14s. 6d. per share to the ordinary shareholders, and £38 per preference share—the Corporation paying in addition £350 towards the Company's expenses in carrying out the arrangement, and the surplus, if any, would be at the disposal of the Company, to be dealt with as they should think right. The purchase-money of £80,000 had to be paid by the Corporation in cash; the transaction to be completed by June 30 next, or within one month after the Bill received the Royal assent. A resolution approving the Bill was passed.

Gas Coal Contracts.—The *Sheffield Independent* states that a meeting of gas coal owners was held at the Victoria Hotel last Tuesday, when questions relating to contracts with the gas companies were discussed. A number of provincial gas companies have recently placed contracts in the district, including such large concerns as Liverpool and Salford; and in every case, our contemporary understands higher prices have been conceded. The compact between the owners with regard to these prices is being well observed; the only exceptions being in the less important contracts.

Electric Lighting for Salisbury.—After two protracted debates on the subject, the Salisbury Town Council have consented to an intended application by the Salisbury Electric Light and Supply Company, Limited, to the Board of Trade for a Licence to supply the district with electric lighting. In the course of the proceedings at the first sitting, Mr. G. Fullford, the Chairman of the Gas Company, magnanimously offered to the new venture his best wishes, and stated that he felt confident, whenever the electric light was introduced, it would not interfere one iota with the Gas Company.

The Water Supply in the Atherstone Rural Sanitary Authority's District.—Mr. R. Walton, one of the Local Government Board Inspectors, recently held an inquiry at Bentley, into an application by the Atherstone Rural Sanitary Authority for permission to contract a loan of £11,412, for works of water supply for Baddesley, Emor, Baxterley, Bentley, and Merivale. A memorial was presented from about a dozen ratepayers and property-owners of Baddesley in opposition to the scheme, on the ground that it was too costly. On the other hand, the Vicar of the parish (the Rev. Wilson Lee) expressed the opinion that the scheme was very necessary, as water was much wanted in the parish.

The Corporation of Cheltenham and the Tewkesbury Water Supply.—Sir G. B. Bruce has been sitting as Arbitrator at the Westminster Palace Hotel, under the provisions of the Cheltenham Water Act, 1878, to consider and decide the terms upon which water should be supplied by the Cheltenham Corporation to the Corporation of Tewkesbury. Cheltenham had until September last supplied water to houses within the borough of Tewkesbury, upon the rating of each property taking the supply. But at that date, being the limit of fifteen years allowed by the Act, the Tewkesbury Corporation exercised their option of taking the water required within their area in bulk; themselves supplying and rating the consumers. The negotiations between the two Corporations having failed in arriving at a basis of arrangement, formal arbitration under the provisions of the Act, and in accordance with the Public Health Act, ensued. In default of an agreement as to terms, the Act provided that an arbitrator should be called in under the usual conditions of the Public Health Act, who should decide what price Tewkesbury should pay per 1000 gallons of water delivered under all the circumstances of the case, and taking into account the fact that the pipes used for the distribution of the water to consumers were the property of the Corporation of Cheltenham. The Tewkesbury Corporation contend that the arbitrator should arrive at the price to be paid by Tewkesbury upon the cost of the works at Tewkesbury without reference to the cost of the hill service required by "fastidious Cheltenham people;" while the Cheltenham Corporation insisted that the cost of the supply must be fixed with regard to the cost of the supply of the whole water district which Parliament has created. The Tewkesbury Corporation say that 6d. per 1000 gallons would be an adequate allowance; the Cheltenham Corporation contend that, while they have hitherto been supplying Tewkesbury at something above 8d. per 1000 gallons under the old arrangement, they are entitled to receive from 10d. to 14d. per 1000 gallons, under conditions which will dissolve the partnership that has hitherto united the two towns in one rating, and which require a strict rendering of the provisions of the Act.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1061.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	**GAS COMPANIES.**				£ s. d.
590,000	10	12 Apl.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	,,	7½	Do. 7 p.c.	10	12—13	..	5 15 4
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
100,000	20	14 Dec.	8	Bahia, Limited	20	10—11	..	14 10 10
200,000	5	11 May	6½	Bombay, Limited	5	5—5½	..	5 18 2
40,000	5	,,	6½	Do. New	4	4—4⅛	..	5 15 6
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	217—222	..	5 3 7
180,000	,,	,,	8½	Do. New	100	167—172	..	5 18 10
220,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	210—215	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	109—112	..	4 9 3
320,000	20	29 Mar.	11½	British	20	45—47	..	5 15 10
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21—22	..	5 6 7
51,510	10	,,	8½	Do. 7 p. c.	10	16—17	..	5 0 0
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5½—6½	..	5 1 6
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	100—103	−1	5 16 9
150,000	20	28 Feb.	8	Cagliari, Limited	20	26—27	..	5 18 6
550,000	Stck.	12 Apl.	12½	Commercial, Old Stock	100	253—258	+1	4 16 10
165,000	,,	,,	9½	Do. New do.	100	190—195	..	4 17 5
160,762	,,	14 Dec.	4½	Do. 4½ p c. Deb. do.	100	132—137	..	5 8 8
800,000	Stck.	14 Dec.	13	Continental Union Limited	100	235—240	..	5 8 4
200,000	,,	,,	10	Do. 7 p. c. Pref	100	207—212	+2	4 14 9
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk.	100	105—110	..	4 10 11
486,090	10	31 Jan.	10	European, Limited	10	22—23	..	4 6 11
354,060	10	,,	10	Do. Partly paid	7½	15½—16½	..	4 10 11
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	230—235	+5	5 5 1
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	100—104	..	3 16 11
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	273—278	..	3 19 0
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	177—182	+2	3 16 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	272—277	..	3 18 3
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 3
1,061,150	,,	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	132—137	..	3 5 8
908,000	,,	,,	6	Do. 6 p. c. do	100	177—182	..	3 5 11
3,800,000	Stck.	11 May	12	Imperial Continental	100	215—220	..	5 9 1
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	109—111	..	4 10 1
541,920	20	15 Nov.	5	Monte Video, Limited	20	14—15	+½	6 11 4
150,000	5	30 May	8	Oriental, Limited	5	5⅛—6*	..	6 13 4
60,000	5	29 Mar.	7	Ottoman, Limited	5	3½—4½	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	1½—2	−½	10 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—107	..	5 12 1
500,000	100	1 June	6	and Do.	100	95—100*	+1	6 0 0
150,000	10	26 Apl.	6	San Paulo, Limited	10	9½—10½	..	5 14 3
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	317—322	..	4 16 3
1,350,000	,,	,,	12	Do. B do.	100	260—265	..	4 10 6
260,000	,,	,,	13	Do. C do.	100	265—270	..	4 16 3
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	153—157	..	3 3 8
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	277—282	..	3 10 11
1,720,252	Stck.	12 Apl.	8	East London, Ordinary	100	223—228	..	3 10 2
544,440	,,	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	..	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	117—120	..	3 10 10
708,000	Stck.	28 Feb.	11½	Kent	100	290—295	..	3 17 11
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	255—260	+2	3 13 1
406,200	100	,,	7½	Do. 7½ p. c. max.	100	204—208	+1	3 12 1
330,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	14 Feb.	12½	New River, New Shares	100	365—370	..	3 5 6
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—136	..	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	100	162—165	..	3 12 9
126,500	100	,,	6	Do. D 7½ p. c. do.	100	147—152	..	3 19 0
1,155,066	Stck.	14 Dec.	10	West Middlesex	100	270—275	..	3 12 9

*Ex div.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

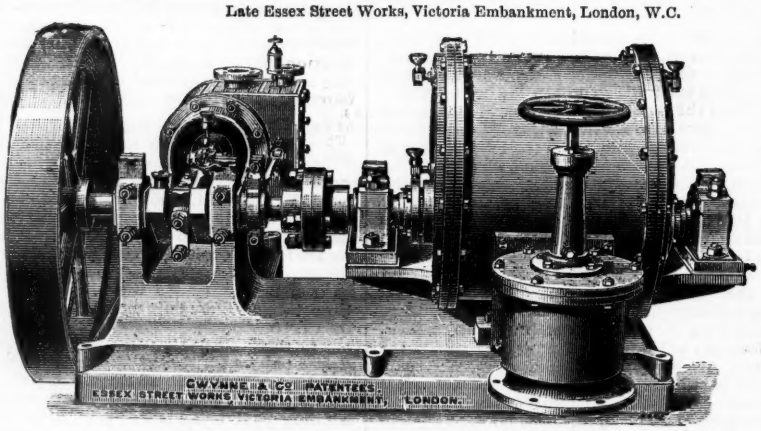
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co.; for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications *re* OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BEIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 300 British Gas-Works. [See Advt., p. 875.]
ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C. Telegrams: "Volcanism, London."

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

CHARTERING, FORWARDING, AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See last week, p. 995.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

MANAGER and Chemist of Tar and Ammonia Works is open for an ENGAGEMENT. Highest references.
Address No. 2389, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Gas Stoker, or the care of Small Works. Understands Main and Service Laying and Meter Reading. Thirteen years' experience, good reference. Moderate wages.
Apply to F. SELBY, 2, St. Leonard's Road, Colchester, ESSEX.

WANTED (by July 1), a steady, trust- worthy MAN, to take SOLE CHARGE of Small Gas-Works, making 1,400,000 feet.
Apply, stating age and wages required, to MYLES GILBERT, Secretary to the Gaslight Company, NEEDHAM MARKET.

WANTED (at once), a Manager for Tar Distillery; experienced, and some Engineering and Clerical Knowledge required. Workman's hours.
Write, stating experience, age, salary, references, &c., to No. 2396, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a steady Man to take charge of the Hartley Wintney Gas-Works. Coal used 250 tons. If able to do Gas-Fitting would be preferred. Wages 20s. per week for eight Summer Months, 24s. for four Winter Months, with House, Garden, Firing, and Gas.
Apply to Mr. KENWARD, Hartley Wintney, Winchfield, HANTS.

TOWER Scrubber Wanted (second-hand), having a capacity of 600 or 700 cubic feet.
Price and full Particulars to G. HELPS, HINCKLEY.

WANTED, Sharp Sand (Washed), suit- able for Water-Works Filter-Beds (Cheshire).
For further Particulars, address No. 2367, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating price per ton and quantity, No. 2390, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RETORT Mouthpieces and Lids, with mounting, Ω-shaped, 15 in. by 13 in., in good condition; cheap.
Address BLAIRGOWRIE GAS COMPANY, LTD.

JAMES LAWRIE & Co. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. III., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

MR. J. C. CHAPMAN, Fellow of the Chartered Institute of Patent Agents, advises on all matters connected with LETTERS PATENT FOR INVENTIONS and the PROTECTION OF TRADE MARKS, &c., at home and abroad. Preliminary Information and Handbook on application.
70, Chancery Lane, LONDON, W.C.

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND CO., Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND CO., Chemical Manufacturers, BIRMINGHAM, LEEDS, and WAKEFIELD.

GREAT GRIMSBY GAS COMPANY.

TO GAS-ENGINE MAKERS.
LINCOLNSHIRE AGRICULTURAL SHOW
AT GREAT GRIMSBY, JULY, 1894.

THERE will be a good Supply of Gas LAID ON TO THE SHOW GROUND. The present Price is 2s. 4d. per 1000 cubic feet.
WILLIAM DREWRY,
Engineer and Manager.

FOR SALE—One 60 feet Round Station METER. Has only been used a short time.
Apply to the HAPTON CHEMICAL WORKS, near ACCRINGTON.

FOR SALE—Two 16 feet and Four 17 feet square PURIFIERS, which have been taken out to be replaced by larger ones.
For Particulars and Prices, apply to W. C. HOLMES AND CO., Gas Engineers, HUDDERSFIELD.

COUNTY BOROUGH OF BOLTON.
(GAS DEPARTMENT.)

TWO STATION METERS ON SALE.

ON SALE—Two Station Meters, one to pass 40,000 cubic feet of Gas per hour with 16-inch Connections and Valves (made by Braddock, Oldham), the other to pass 45,000 cubic feet per hour, with 16-inch Connections and Valves (made by the Gas-Meter Company, Limited). The Meters are now in use, in good condition, and being removed to make room for Meters of larger capacity.
Further Particulars may be obtained on application to Mr. William Smith, Gas Engineer, Lum Street Gas-Works, Bolton.
Tenders, endorsed "Station Meters," to be addressed to Alderman Miles, Chairman, Gas Committee, Bolton.
R. G. HINNELL,
Town Clerk.
May 22, 1894.

THE Hindley Local Board are prepared to receive TENDERS for the supply of GAS COAL, THROUGH and THROUGH, COBBLES, NUTS, SLACK, CANNEL, and LIME required at their Gas-Works during the ensuing Twelve Months, and also for the purchase of the TAR and AMMONIACAL LIQUOR produced at their Gas-Works during the ensuing Twelve Months.
Full Particulars with Forms of Tender can be obtained on application to Mr. Wm. Dickinson, Gas and Water Manager.
Sealed tenders, endorsed "Tender for Gas Coal, &c.," to be lodged with the undersigned not later than Monday, June 18, 1894.
By order,
STEPHEN HOLT,
Clerk to the Local Board.
Offices: Cross Street, Hindley,
June 1, 1894.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

COAL CONTRACT.

THE Directors of the Hexham Gas Com- pany are prepared to receive TENDERS for the supply of about 2400 tons of unscreened GAS COAL, delivered at Hexham Station, as directed, during the Twelve Months ending June 30, 1895.
Tenders, with Analysis of Coal and name of Pit at which it is raised, to be forwarded to the undersigned not later than the 9th of June.
HERBERT LEES,
Secretary and Manager.
Gas-Works, Hexham,
May 16, 1894.

BOROUGH OF EVESHAM.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Corporation invite Tenders for the supply of from 500 to 1500 tons of best screened GAS COAL during the Year ending the 30th of June, 1895, to be delivered on Rail at Evesham.
Tenders to be sent in to me not later than the 22nd of June inst.
The Corporation do not bind themselves to accept the lowest or any tender.
THOS. COX,
Town Clerk.
Town Clerk's Office, Evesham,
June 1, 1894.

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the supply of about 15,000 tons of CANNEL and about 200,000 tons of best GAS COALS (screened or nuts). Price per ton to be quoted, delivered at their Gas-Works, Meadow Lane (Hunslet Lane Siding), New Wortley (Gelderd Junction Siding), or at the Gas-Works, York Street, in such quantities as may be required. The contract to commence the 1st of July next, and terminate the 30th of June, 1895.
Forms of Tender may be obtained on application to Mr. Lupton, General Superintendent, Gas Department, Municipal Offices, Calverley Street.
Tenders may be for any portion of the total quantity required, and will be received not later than Wednesday, the 20th of June next, addressed to the Chairman of the Gas Committee, Municipal Offices, Calverley Street, and endorsed "Tender for Coal."
The lowest or any tender will not necessarily be accepted.
May 26, 1894.

WIRKSWORTH GASLIGHT AND COKE COMPANY, LIMITED.

TENDERS FOR COAL.

THE above Company will be glad to receive TENDERS for 800 tons (more or less) of well-screened GAS COAL, free from Bats, Bind, Pyrites, or any other Impurities, and delivered free, at the Wirksworth (Midland) Railway Station, in such quantities as the Manager may from time to time require during the Twelve Months from date of Contract.
Sealed tenders, endorsed "Tender for Coal," to be sent to R. Wall, Esq., Chairman, on or before June 13, 1894.
Those tendering will please say where such coal is being used, and send working analysis to the Manager

TENDERS FOR TAR.

The above will also be glad to receive TENDERS for TAR for Twelve Months, dating from and after May 1, 1894.
Sealed tenders, endorsed "Tender for Tar," to be sent to R. Wall, Esq., Chairman, on or before June 13, 1894.
(Signed) JAMES LEE,
Secretary and Manager.

THE Directors of the Ware Gaslight and Coal and Coke Company, Limited, invite TENDERS for the supply of from 900 to 1200 tons of EAST PONTOP, NEW PELTON, or PELAW MAIN GAS COALS, to be considered at their Meeting to be held on Tuesday, the 12th day of June next.

Full Particulars may be obtained on application to me the undersigned at my Office.

Dated this 29th day of May, 1894.

By order of the Board,
GEO. H. GISBY,
Secretary to the Company.

Baldock Street, Ware.

AYR GAS COMPANY, LIMITED.

THE Directors of the above Company invite TENDERS for the supply of the following CAST-IRON PIPES, Uncoated, Turned, and Bored, viz.—

1020	Yards	8-inch	Weight per Yard,	120	lbs.
1245	„	6-inch	„ „	89	„
2220	„	5-inch	„ „	68	„

Also sundry IRREGULARS.

All per ton f.o.r. at Townhead Railway Depôt, Ayr.

The Directors also invite TENDERS for LAYING THE SAME.

Tenders to be sent to me on or before the 12th of June.

W. SMITH,
Manager.

COUNTY BOROUGH OF OLDHAM.

THE Gas-Works Committee invite Ten- ders for the TAR and AMMONIACAL LIQUOR, to be produced at their different Gas Stations for a period of One Year, commencing the 1st of July next.

The yearly make of Tar is about 6400 tons; and of Ammoniacal Liquor, about 2,400,000 gallons.

Particulars and Forms of Tender can be obtained on application to Mr. Arthur Andrew, Gas and Water Offices, Oldham, to whom tenders are to be sent on or before Tuesday, the 12th of June, 1894.

A. NICHOLSON,
Town Clerk.

Oldham, May 31, 1894.

FROME GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the supply of from 500 to 4200 tons of best screened GAS COAL, to be delivered at the Gas-Works Siding, between July 1, 1894, and June 30, 1895.

Tenders to be sent to me not later than June 23, 1894, endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

H. F. VINCENT,
Manager.

Gas-Works, Frome,
June 2, 1894.

THE BRISTOL GAS COMPANY.

TENDERS FOR GAS COAL AND CANNEL.

THE Directors of the above Company are prepared to receive TENDERS for the supply of their requirements (say, 150,000 tons) of GAS COALS during the period commencing the 1st of September next and ending the 30th of June, 1895.

Particulars and Forms of Tender may be obtained on application to the undersigned, to whom also tenders, sealed and endorsed "Tender for Coal," must be delivered not later than Ten a.m., on Wednesday, the 20th day of June next.

JOHN PHILLIPS,
Secretary.

Chief Offices, Canons' Marsh, Bristol,
June 1, 1894.

CORPORATION OF LANCASTER GAS DEPARTMENT.

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of screened GAS COALS, delivered on the Gas-Works Siding, Lancaster, in such quantities and at such times as may be required, during a period of One, Two, or Three Years, commencing delivery Sept. 1 next.

Sealed tenders, endorsed "Gas Coal," giving full particulars of the Coal offered, must be delivered to W. O. Roper, Esq., Town Clerk, Lancaster, on or before the 18th day of June next.

Forms of Tender may be obtained on application to the undersigned.

The lowest or any tender not necessarily accepted.

CHAS. ARMITAGE.

Gas-Works, Lancaster,
May 28, 1894.

OLDBURY LOCAL BOARD OF HEALTH.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of about 7000 tons of well-screened GAS COAL, for delivery during the Year ending June 30, 1895, in such quantities and at such times as ordered.

The Coal must be of first-class quality, freshly wrought, and perfectly free from Bats, Pyrites, and other Foreign Matter.

Form of Tender and other Particulars can be obtained on application to the undersigned.

Tenders to state the price delivered (1) at the Great Western Railway, Oldbury; (2) London and North-Western Railway, Oldbury; and (3) London and North-Western Railway, Albion.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Coal," to be delivered to me not later than Saturday, June 16 next.

The Gas Committee do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order
A. COOKE,
General Manager.

Gas-Works, Oldbury,
June 2, 1894.

THE INCORPORATED

Gas Institute.

THE THIRTY-FIRST

ANNUAL GENERAL MEETING

OF THE MEMBERS

WILL BE HELD ON

Tuesday, Wednesday, and Thursday,

the 19th, 20th, and 21st June, 1894,

AT THE

WESTMINSTER TOWN HALL,

LONDON, S.W.

THE CHAIR WILL BE TAKEN BY THE PRESIDENT,

JOHN WEST, ESQ., M.Inst. C.E.

On Friday there will be a Trip to Oxford, viewing the Colleges and Chapels, and, after Luncheon, a Steamer Trip to Nuneham. Full particulars will be announced on the Programme.

THE BENEVOLENT FUND.

The Annual General Meeting of the Donors and Subscribers to the Benevolent Fund will be held on Tuesday, June 19, at 5 o'clock p.m.

FREDK. G. BURFIELD, Secretary.

13, Victoria Street, Westminster, S.W.

TO MANUFACTURING CHEMISTS.

TAR AND AMMONIA WATER.

THE Directors of the Loughborough Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIA WATER, to be produced at their Works for One Year, from the 30th day of June.

The estimated quantities will be about 350 tons of Tar, and 900 tons of Ammonia Water. The Tar and Liquor to be delivered into the Contractor's Boats at the Wharf, on the Derby Road, Loughborough.

The strength of the Liquor to be tested by Twaddel's Hydrometer (temperature 60°); and the tender to state the price per ton of 4° rising ½° up to 8°.

The boats for the removal of the Tar and Liquor to be sent at such times as may be required. Payments 10th of following month.

Further Information may be obtained on application to the undersigned, to whom tenders, in accordance with this advertisement, must be sent not later than the 9th day of June.

The Directors do not bind themselves to accept the highest or any tender.

J. B. BALL, C.E.,
Manager.

Loughborough, May 26, 1894.

TENDERS FOR GAS COAL.

THE Gas Committee of the Town Com- missioners of Newry invite TENDERS for the supply of from 3000 to 3600 tons of GAS COAL, to be delivered in such quantities as may be required by the Committee, and delivered free *ex* Ship or Steamer at Albert Basin, Newry, or f.o.b. at their Shipping Port.

The Coal to be fresh wrought, dry, and free from Clench, Pyrites, or other objectionable matter for Gas Making.

The Committee would assist the Contractor by allowing him to deliver about 1000 tons of Coal prior to the 1st of November next.

Further particulars may be obtained from Mr. A. Gibb, Manager.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, and where raised, to be addressed to the Chairman, and delivered to the undersigned not later than Ten a.m., on Friday, the 8th of June next.

The Committee reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

By order,
R. H. DOHERTY,
Town Clerk.

New Town Hall, Newry,
May 25, 1894.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 20,000 tons of GAS COAL for One Year from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Wharf, High Orchard, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by water, the price f.o.b., and also the price delivered at the Gas Company's Wharf on the Gloucester and Berkeley Canal.

Further Particulars and Forms of Tender may be obtained of the Company's Engineer, Mr. R. Morland.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than Monday, the 11th day of June next.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

By order
WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
May 10, 1894.

BOROUGH OF WARRINGTON.
(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation invite TENDERS for the supply of 15,000 tons of COAL and 2000 tons of CANNEL.

Further Particulars and Form of Tender can be obtained on application to Mr. W. S. Haddock, Engineer, Gas-Works.

Sealed tenders, endorsed, and addressed to the Chairman of the Gas Committee, Gas Offices, must be sent in by Ten a.m. on Friday, the 8th prox.

FREDK. TAYLOR.

Gas Offices, Warrington,
May 25, 1894.

SCARBOROUGH GAS COMPANY.

THE Directors of the Scarborough Gas Company invite TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at their Works, for One Year from the 1st of July next.

Tenders for Liquor may be submitted either at a fixed price per ton or on a sliding scale, regulated by the price of Sulphate. Preference will, however, be given to the latter.

Further Particulars may be obtained on application to the undersigned, to whom tenders (properly endorsed) must be delivered not later than Noon, on Tuesday, the 12th day of June next.

(Signed) J. HOLLIDAY,
Secretary and General Manager.

COUNTY BOROUGH OF BURY.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee of the Corporation of Bury are prepared to receive TENDERS for the supply of GAS COAL and CANNEL for a period of Nine Months, commencing on the 1st day of October, 1894, to be delivered free at the Corporation Siding, Bury, in equal monthly quantities.

Estimated quantities about 16,000 tons of Coal, and 1500 tons of Cannel.

Full Particulars and Form of Tender may be obtained on application to Mr. W. H. S. Gendall, Engineer and Manager, Gas-Works, Elton, Bury.

Sealed tenders, endorsed "Tender for Coal and Cannel," to be sent to me, the undersigned, on or before June 23, 1894.

The Corporation do not bind themselves to accept the lowest or any tender.

JOHN HASLAM,
Town Clerk.

Corporation Offices, Bury,
June 1, 1894.

BOROUGH OF BRIGHOUSE.

THE Mayor, Aldermen, and Burgesses of the Borough of Brighouse, acting by the Council, are prepared to receive TENDERS for the supply of the following STORES—viz., FIRE-CLAY GOODS, IRONMONGERY, BRASS MAIN-COCKS, New WET GAS-METERS, New DRY GAS-METERS, OIL PAINTS, &c., STEEL GOODS, WROUGHT-IRON TUBES and FITTINGS, WROUGHT-IRON GOODS, and BRUSHES, required by the Gas Committee during the Year ending March 25, 1895.

Specification and Form of Tender can be obtained on application at the Gas Engineer's Office, Public Offices, Brighouse.

Sealed tenders are to be sent in on or before Saturday, June 9, 1894, addressed to the Town Clerk, Public Offices, Brighouse.

The lowest or any tender not necessarily accepted.

By order,
JAMES PARKINSON,
Town Clerk.

Public Offices, Brighouse,
May 25, 1894.

ALTRINCHAM GAS COMPANY.

COAL AND CANNEL CONTRACTS.

TENDERS are invited for best screened GAS COAL and CANNEL for One, Two, or Three Years from the 1st of August next.

Deliveries to be free at the Gas-Works Siding, Altrincham Railway Station, as required.

Sealed tenders, endorsed "Tender for Coal and Cannel," stating the description of the Pits from which they are to be raised, the amount proposed to be supplied, and Cash Terms for Monthly Payments, to be sent, addressed to the undersigned, so as to be received not later than Twelve o'clock Noon, on Tuesday, the 12th day of June, 1894.

The Directors do not bind themselves to accept the lowest or any tender; but the person or persons whose tender may be accepted will be required to execute an Agreement for the due performance thereof.

No special Form of Tender is required or supplied.

F. R. B. LINDSELL,
Secretary.

Gas Offices, Moss Lane, Altrincham,
June 1, 1894.

COMMERCIAL GAS COMPANY.

TENDERS FOR COAL.

THE Directors are prepared to receive TENDERS for the supply of 180,000 tons of clean, dry, unscreened, fresh-wrought GAS COALS, delivered f.o.b. to the Company's Steamers at any suitable Port, during the Year ending the 31st of July, 1895.

The deliveries to be in equal monthly quantities throughout the Year.

Payment in cash monthly.

Parties desiring to tender for more than One Year must state separately the price and quantity offered for each Year.

Particulars and Forms of Contract may be obtained from the Engineer, Mr. H. E. Jones.

The Directors do not bind themselves to accept the lowest or any tender.

Tenders, sealed and endorsed "Tender for Coals," to be addressed to the Chairman of the Coal Committee, and delivered at the Company's Offices not later than Twelve o'clock on the 20th of June, 1894.

Commercial Gas-Works, Stepney, E.,
May 24, 1894.

COUNTY BOROUGH OF HUDDERSFIELD.

GAS COAL.

THE Gas Committee are prepared to receive TENDERS, from Colliery Proprietors only, for the supply and delivery of from 40,000 to 60,000 tons of GAS COAL.

Form of Tender and full Particulars may be obtained on application to Mr. W. R. Herring, Engineer, Gas-Works, Huddersfield. Sealed tenders, endorsed "Tender for Coal," to be addressed and sent to him not later than Thursday, the 7th of June, 1894.

By order,
H. BARBER,
Town Clerk.

Huddersfield, May 22, 1894.

ROCHESTER, CHATHAM, AND STROOD GAS-LIGHT COMPANY.

SUPPLY OF COALS.

THE Directors invite Tenders for the supply of about 40,000 tons of GAS COALS, to be delivered between the 1st of August, 1894, and the 31st of July, 1895.

Further Particulars with Forms of Tender and Contract may be had on application.

Sealed tenders, marked "Coals," are to be delivered to me at these Offices not later than Noon of Thursday, the 28th of June, 1894.

J. M. VEEVERS,
Engineer and Secretary.

Gas Offices: 58, High Street, Rochester,
May 31, 1894.

UFFCULME GAS COMPANY, LIMITED.

THE Directors of the Uffculme Gas Company, Limited, invite TENDERS for the purchase of their FREEHOLD PREMISES, together with the whole of the PLANT, MACHINERY, and STOCK IN TRADE, with the GOODWILL as a going Concern, and including the GOODWILL and STOCK IN TRADE of the Business of COAL MERCHANTS also carried on by the Company.

The Purchaser will also have the option of taking off the Book Debts.

To view, apply to the Secretary, Mr. John Thorn, Uffculme, Cullompton; and for further Particulars apply to the Secretary or to the undersigned Solicitor, at whose Offices the Conditions of Sale may be seen.

Sealed tenders should be sent not later than the 19th day of June, 1894, to the Secretary or to the undersigned.

The Directors do not bind themselves to accept the highest or any tender.

E. LEE MICHELL,
Solicitor.

Wellington, Somerset,
May 24, 1894.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gas-light Company invite TENDERS for the supply of about 12,000 tons of screened GAS COALS, and about 1000 tons of good ENGLISH CANNEL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the Year commencing July 1, 1894, and ending June 30, 1895.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any tender.

Tenders must be made on Forms (containing further particulars), which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 22nd day of June, 1894.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 22, 1894.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to Debenture Stocks and Bonds, will be closed at One o'clock p.m., on Saturday, the 9th prox., for the Half Year ending on the 30th prox., and will be re-opened on the Morning of Monday, the 11th prox.

The Interest for the Half Year will be payable on the 2nd of July next, to the Proprietors registered on the closing of the Books.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., May 31, 1894.

CROYDON COMMERCIAL GAS AND COKE COMPANY.

SALE, BY TENDER, OF 500 ORDINARY SHARES OF £10 EACH,

Being a portion of the Additional Capital Authorized to be raised under the Powers of the Croydon Gas Act, 1877.

MINIMUM PRICE, £22 PER SHARE.

THE Directors give notice that they will be prepared to receive, not later than Eleven o'clock on the Morning of Wednesday, the 6th of June, 1894, sealed TENDERS for 500 ORDINARY SHARES of £10 each, to be paid up in full on or before the 30th of June, 1894, and to bear Dividend from that date.

The last Dividend paid upon this class of Shares was at the rate of 11 per cent. per Annum.

One £10 Share, or any number of the 500 Shares, can be tendered for.

Printed Particulars and Conditions of Sale, and Form of Tender, may be obtained at the Offices of the Company, Katharine Street, Croydon.

WILLIAM J. RUSSELL,
Secretary.

May 2, 1894.

NOTICE.

BANDON TOWN COMMISSIONERS (CO. CORK).

ALL Persons having Accounts against the above, are hereby requested to FURNISH PARTICULARS OF SAME, to the undersigned, AT THE EARLIEST PRACTICABLE PERIOD.

JOHN M'DONNELL,
Town Clerk.

Board-Room, Gas-Works,
Bandon, May 29, 1894.

By Order of the Directors.—Important Sale of £7500 4 per cent. Perpetual Debenture Stock, in that prosperous Undertaking the Southend Gas Company, to be created and issued under the Provisions of the Southend Gas Act, 1892. The Ordinary Shares of the Company have paid 10 per cent. and 7 per cent. respectively for many years past; and this Debenture Stock therefore forms an investment of the very highest character.

MR. ALFRED RICHARDS will sell the above BY AUCTION, at the Mart., E.C., on Tuesday, June 19, at Two o'clock precisely, in Lots.

Particulars of J. T. RANDALL, Esq., Secretary, High Street, SOUTHEND; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

SALE OF NEWPORT (MON.) GAS SHARES.

(UNDER THE PROVISIONS OF THE COMPANY'S ACT, 1886.)

MESSRS. PARSONS AND ROBJENT have received Instructions from the Directors to SELL BY PUBLIC AUCTION, at the King's Head Hotel, Newport, Mon., on Wednesday, the 13th day of June, 1894, at Three o'clock in the Afternoon,

SIXTY CLASS "C" SHARES OF £100,

in Lots of one Share each.

The Statutory Dividend is 7 Per Cent. per Annum.

Particulars and Conditions may be had on application to the AUCTIONEERS, Central Chambers, NEWPORT; or to EDWARD F. MARFLEET, Secretary, at the Offices of the Company, NEWPORT, MON.

Dated May 4, 1894.

BROMLEY GAS CONSUMERS' COMPANY.

SALE BY AUCTION OF 500 ORDINARY SHARES OF £10 EACH.

THE Directors give notice that they have instructed Messrs. Baxter, Payne, and Lepper to sell BY AUCTION, at the Bell Hotel, Bromley, Kent, on Wednesday, the 20th of June, 1894, at Eight o'clock p.m. precisely, in Lots of Five and Ten Shares each, 500 ORDINARY SHARES of £10 each in the Bromley Gas Consumers' Company.

The Dividend paid upon this class of Shares for the past Three Years has been at the rate of 8½ per cent. per Annum.

Particulars and Conditions of Sale may be obtained of the SECRETARY of the Company; Messrs. WILLETT AND LATTER, Solicitors, Market Square, Bromley, KENT; and of the AUCTIONEERS, Market Square, Bromley, KENT.

By order,
H. W. AMOS,
Secretary.

Bromley, Kent,
May 30, 1894.

AMMONIA SATURATORS.

TO GAS ENGINEERS, SULPHATE OF AMMONIA MANUFACTURERS, ETC.

MESSRS. W. THOMASON AND SONS, Chemical Plumbers, Lead Burners, &c., 21, WESTON STREET, BOLTON, beg to call the attention of Gas Engineers and others to the fact that, having laid down New Plant of the most modern construction, they have now the most complete and best adapted Premises in Lancashire for the Manufacture of LEAD SATURATORS and all kinds of CHEMICAL PLUMBING, and will be pleased TO QUOTE for any kind of LEAD WORK or REPAIRS of any description. By employing first-class Chemical Plumbers only, they can guarantee to give satisfaction to any orders entrusted to them.

Messrs. W. THOMASON AND SONS have on hand, ready for delivery, a Solid Plate Lead Saturator, 5 ft. by 4 ft. by 4 ft., made from 1-inch Lead Plates for the sides and midfeather, and 1½-inch Lead Plates for the top and bottom, burned solidly together by an improved process; and they invite inspection of the same by Gas Engineers or others interested.

Please write for an Estimate before ordering elsewhere. Lead Burners sent out to repairs.

Fcap. 4to, Cloth, price 7s. 6d., post free.

Practical Photometry.

By William Joseph Dibdin, F.I.C., F.C.S.,

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

MICHAEL AND WILL'S GAS AND WATER.

Fourth Edition.—In the Press, in One Volume.

THE LAW RELATING TO GAS & WATER.

Comprising the Rights and Duties, as well of Local Authorities as of Private Companies, in regard thereto; and including the Electric Light Acts and Orders. Fourth Edition. By J. SHIRESS WILL, Q.C., M.P.

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PATENT

CANDLE SAFETY LAMPS.

Are a great improvement on Oil, giving a good Light, requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

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NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

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DALKEITH, N.B.

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Gas Companies are solicited to try Samples of the

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Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

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W. H. PARKINSON,
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Prices and Analysis of all the Scotch Cannels on Application.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to
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GAS COAL.

YIELD OF GAS PER TON · 10,375 CUBIC FEET.
ILLUMINATING POWER · 17·50 SPERM CANDLES.
COKE · · · · · · · 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to
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BOGHEAD · CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

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FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
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Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
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Established 1872.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	PER CENT.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

READY JUNE 15, 1894.

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The above three Books, handsomely bound in One Volume, Price 10s.

The 1894 Editions of these works have, through the courtesy of the Managers of the Companies applied to, been more carefully revised than any previous issue, and are more full of information and more accurate than ever.

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Special features of the Directory are a review of the leading events in the Gas, Water, and Electric Lighting Industries during the past twelve months, and tabulated lists of Gas Managers' Associations, and of Associations of Water and Electric Lighting Engineers in all parts of the world.

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Every Description of Gas Apparatus.

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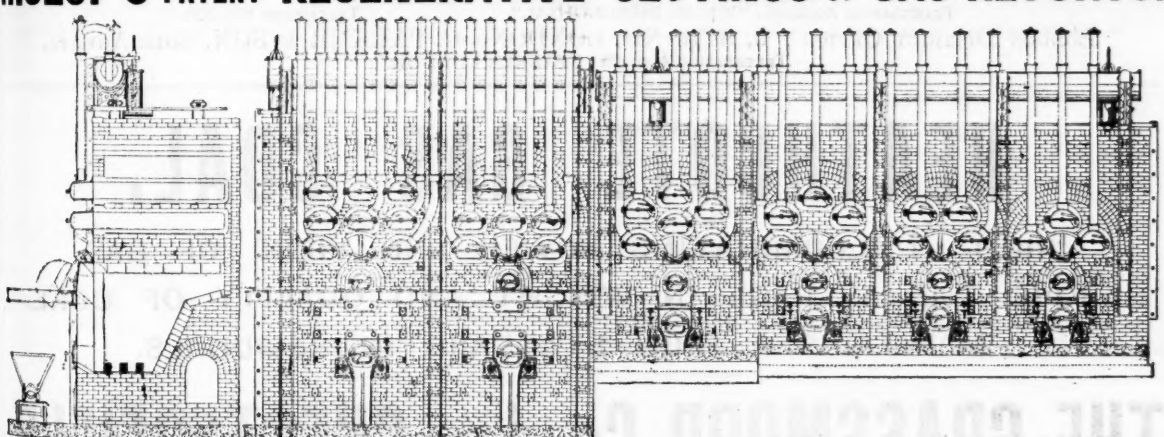

THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS, CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS, AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings; or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

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12,553 Cubic Feet of 50-Candle Gas, or 10,460 Cubic Feet of 60-Candle Gas,

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Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sprem, 820·80. Very free from impurities.
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RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
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Sole Manufacturers of the "PERFECT" Patent LOCK-NUT and WASHER.

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NAPHTHA AND GASOLINE DISTILLERS AND PETROLEUM IMPORTERS,

Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.

Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Petroleum Ether and Naphtha for clearing the pipes of Naphthalene, &c.

Samples and Prices may be had on application.

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ALSO THE LARGEST METAL TANK THE

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IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.

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STATION METERS, EXPERIMENTAL METERS, PHOTOMETERS, & PRESSURE-GAUGES, &c.

Results of Tests of Dry Gas-Meters (Section III.) of the Glasgow Philosophical Society's Gas Exhibition, as per London "Gas Journal," May 10, 1881.

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Total of Fast Tests . .	47·2 ...	6·9 ...	33·6 ...	62·3 ...	53·7
Total of Slow Tests . .	25·3 ...	117·4 ...	43·1 ...	31·4 ...	38·5
	72·5 ...	124·3 ...	76·7 ...	93·7 ...	92·2

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PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works**, adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

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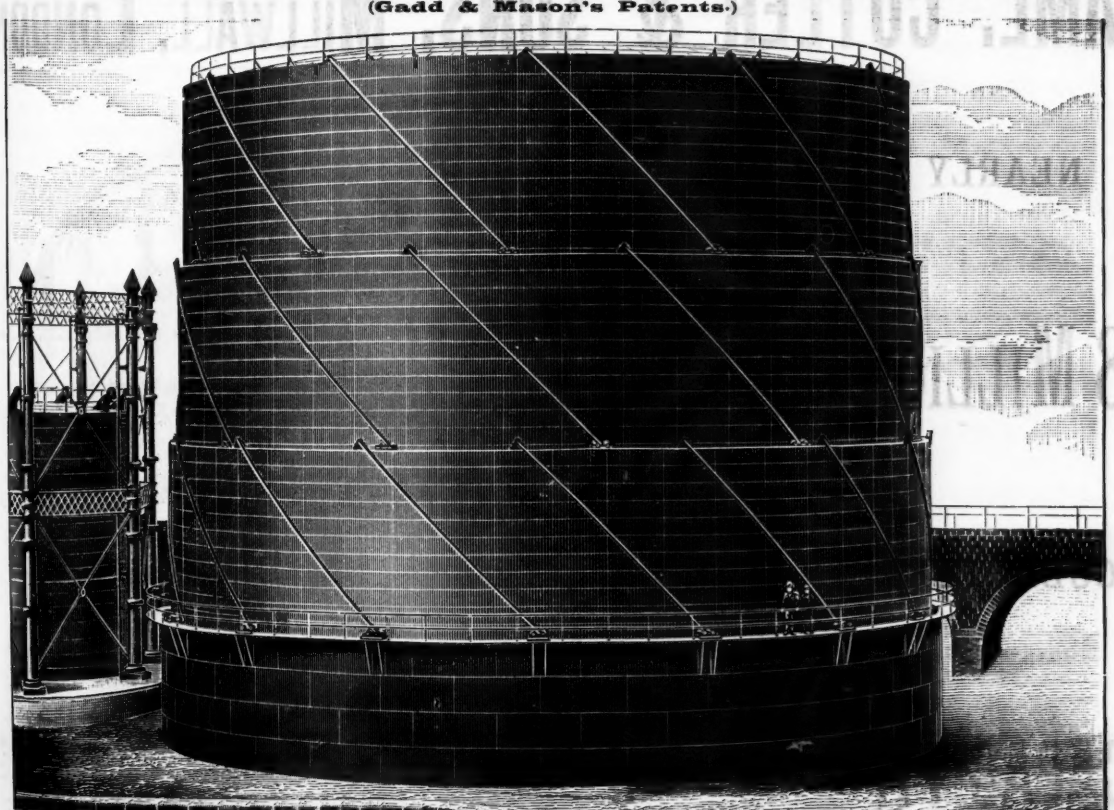

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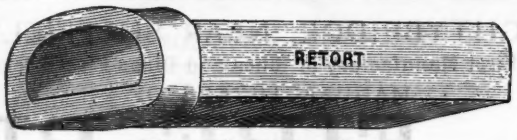

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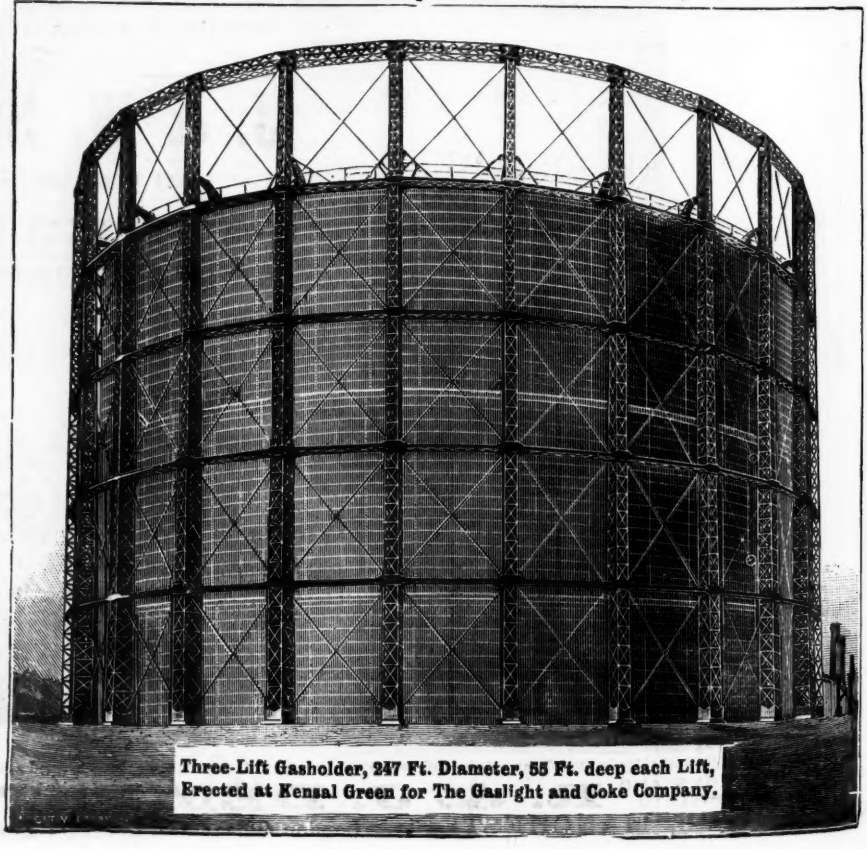

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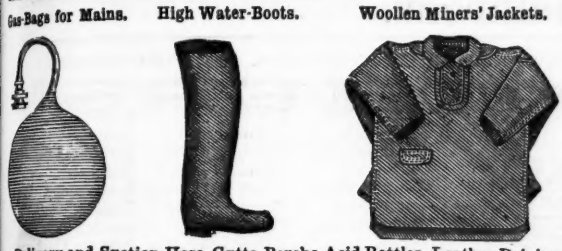

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